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ENVIRONMENTAL IMPACT REPORT

PEABODY COAL COMPANY

BIG SKY MINE

OCTOBER 15, 1973

Unless otherwise noted through references
to appendiced material, the authors of this
report are Peabody Coal Company
and
Ecological Consulting Service

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November 19, 1973

Attached is the draft Environmental Impact Statement prepared on the proposed action of granting a strip mining permit to the Peabody Coal Company for the continuation of their Big Sky Mine near Colstrip, Montana. Because of the time restrictions imposed upon this department by the provisions contained in Chapter 325 (The Montana Strip Mining and Reclamation Act), the Administrative Procedures Act, and the Montana Environmental Policy Act, we have included as part of our statement an analysis prepared by a private consulting firm for Peabody Coal Company.

The Department of State Lands must review the materials submitted by Peabody Coal Company in their application for a strip mining permit pursuant to Chapter 325, SLM, 1973, and determine, on the basis of those materials and any input as a result of public review, whether or not the company will receive a permit to continue their operation and under what conditions of mining and reclamation that permit, if any, is issued. All application materials tendered by Peabody Coal Company are available for public inspection in the Reclamation Division of the Department of State Lands.

In order to obtain wider public consideration and in order to conserve paper, the Peabody analysis has been microfilmed and placed in the Eastern Montana College Library, the University of Montana Library, the Montana State University Library, and the Miles City Public Library. Any interested citizens are invited to use that service.

Any written comments should be submitted to the Environmental Coordinator, Department of State Lands, Staff Services Division, Capitol Building, Helena, Montana, 59601, by December 9, 1973.

Sincerely,

Sharon M. Solomon

Sharon M. Solomon
Environmental Coordinator

NRIS 3

DRAFT ENVIRONMENTAL IMPACT STATEMENT

ADMINISTRATIVE ACTION - Proposed Approval of Strip Mining Permit for the Continuation of the Peabody Coal Company Big Sky Mine near Colstrip, Montana

Submitted Pursuant to the Montana Environmental Policy Act
Section 69-6504 (b) (3), R.C.M. 1947

Prepared by

STAFF SERVICES DIVISION
MONTANA DEPARTMENT OF
STATE LANDS

HELENA, MONTANA
November 19, 1973

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I. INTRODUCTION

Section 28, Chapter 325, SLM, 1973, The Montana Strip Mining and Reclamation Act specifies that: "Ninety (90) days after the effective date of this act, the state shall proceed to cancel, according to their terms, all existing contracts entered into pursuant to Chapter 245, Laws of Montana, 1967."

The effective date of Chapter 325 was March 16, 1973. Ninety days after that date (June 14, 1973) the Department of Natural Resources sent out contract cancellation notices specifying that the contract with Peabody Coal Company would be cancelled 6 months from the date of receipt of the notice. Peabody's present reclamation contract with the State of Montana thus will be cancelled on December 19, 1973. From that date on Peabody Coal Company must have a permit from the Department of State Lands to continue mining.

Although Chapter 325 went into effect on March 16, 1973, the rules and regulations adopted pursuant to it were not officially adopted until September 5, 1973. Therefore, prior to that date neither the companies nor the department were entirely certain what would be required to make a complete application.

Since then Peabody Coal Company has made every effort to submit its application materials to this department promptly, and the department has thoroughly reviewed those materials as rapidly as time and personnel allow.

The review of those materials and the field inspections of the proposed permit area will be the basis of the permit decision by the department along with any input based on this statement and analysis.

The Montana Environmental Policy Act (Sections 69-6501 thru 69-6517, RCM, 1947) and the guidelines adopted by the Montana Environmental Quality Council require State agencies to prepare an environmental impact statement when acting upon permit requests for operations which may have a significant effect on the environment, which may precipitate the first decision in a series of decisions that may have a cumulative effect on the environment, or which may be controversial. Granting a permit to strip mine a large area is nearly always controversial. Granting a permit to a presently operating mine constitutes an action which is significant in that it determines that the operation is able to continue and also be in compliance with Chapter 325.

Chapter 325, SLM, 1973, the Montana Strip Mining and Reclamation Act, in part provides that: contour mining is prohibited; unique areas are subject to selective denial of mining; a permanent, diverse vegetative cover must be established; the area of land affected must be returned to the approximate original contour; the method of operation is controlled by the Department; and others. Each of these involves extensive analysis and an ultimate decision on the issuance of a permit by the department.

This evaluation of the possible environmental impact of Peabody's proposed mining operation is not intended to be extrapolated to other mines or to other areas of intended mines. Each has its own special problems and must be treated as a separate entity.

II. DESCRIPTION OF THE PROPOSED ACTION

Peabody Coal Company's Big Sky Mine is a currently operating coal strip mine in Rosebud County, Montana. The proposed mine limits will cover approximately 1,424 acres in Sections 13, 14, 15, 21, 22, 23, and 27 in Township 1 North, Range 41 East. The total acreage applied for in the next twelve months is 393 acres (as amended from 339 acres, October 18, 1973).

The company will mine two seams of coal: the Rosebud and the McKay. These two beds are separated by a barren shale ranging from 7 to 30 feet in thickness while the overburden overlying the top seam, the Rosebud, ranges from near zero to 150 feet. The two coal seams and the associated overburden are part of the Tongue River member of the Fort Union formation.

Further description of the proposed continuation of the current Big Sky Mine is contained in the appended analysis.

III. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

The proposed extension of the current mine area will have a number of impacts as discussed in the appended analysis. Most of these impacts are already in existence as a result of mining activities since 1969.

The provisions of Chapter 325 attempt to modify the impact of mining on the environment and insure that the land is reclaimed to a beneficial use.

Peabody Coal Company has stated in its application for permit that the estimated average cost of reclaiming the land will be $6,500.00 an acre, a very high figure in relation to estimates made by other mining companies in the region. In the application appendix, where reclamation costs are broken down into costs for each individual facet of reclamation, the estimate goes as high as $8,022.28 per acre, apparently excluding revegetation costs. Chapter 325 provides for a maximum bond of $2,500.00 per acre. Therefore, the bond that Peabody will furnish to the Department of State Lands will in no way be close to the estimated cost of reclamation supplied by the company.

Following is the breakdown of acres and bonding as Peabody has determined it under Chapter 325:

	Number Acres
Acres to be mined, box cut spoils, clinker mine site, high wall reduction areas, shopsite and similar areas	225
Areas of roads, railroad lines, shop and erection areas	116
Areas containing powerlines, area immediately ahead of the mining activities and similar areas	52
TOTAL	393

	Amount of Bond
Category 1 - lands will be bonded at the legal maximum of $2,500.00 per acre	$562,500.00
Category 2 - lands will be bonded at the rate of $1,000.00 per acre	$116,000.00
Category 3 - lands will be bonded at the rate of $200.00 per acre	$ 10,400.00
TOTAL Bond Amount to be Furnished to the Department of State Lands	$688,900.00

At an average cost of $6,500.00 per acre the total bond would be $2,554,500.

In 1972, Peabody mined 1,601,181 tons of coal and claimed $41,689.95 (2.6¢ per ton) in reclamation costs under the 1967 Strip Mined Reclamation Law. At that rate, reclamation costs would only be $91,000.00 for the projected 3.5 million tons per year from the Big Sky Mine. If $2,554,500 were spent on reclamation as estimated by Peabody the cost would be about 73¢ per ton.

The reclamation costs claimed by the company may have a significant effect on the tax base of Rosebud County. When calculating the amount of net proceeds tax to be paid to the county, reclamation costs can be deducted from the base figure, thus resulting in a lower net proceeds tax.

One of the major reclamation problems that has faced Peabody at the Big Sky Mine is the so-called blue shale, the interburden located between the Rosebud and the McKay seams. This shale is a laminated sedimentary rock composed principally of clay particles with some sand and silt. When exposed to air and precipitation it takes on physical characteristics which make revegetation techniques very difficult even though a high percentage of micro- and macronutrients exist. Because of the clay particles the exposed shale becomes saturated very quickly when wet and forms a pasty, fluid mass with high erosive capacity. In the swales this saturated shale forms a virtual bog in which livestock or wildlife can easily become mired. As the shale dries it retains its shape and forms a compacted layer in which infiltration is very slow and water uptake by plants very difficult. In past mining plans the shale has ended up on top of the spoil piles. In the current application the mining plan has been revised so that the shale will be buried and not remain where it will inhibit reclamation.

As proposed in the application for permit for the Big Sky Mine, the seeding recommendation contains 21.5 pounds of seed of introduced species and 5.0 pounds of seed of native species. This mixture may cause a change in vegetation patterns in the proposed area to be affected.

The proposed area to be affected during the permit year does not appear to have any known or readily discoverable archaeological, historical, ethnological, or cultural values or any special, exceptional, critical, or unique characteristics that would be subject to Section 9 (Chapter 325) applicability.

IV. ALTERNATIVES TO THE PROPOSED ACTION

Alternatives are discussed in general in the attached analysis. One further alternative deserves discussion, however.

Peabody has put forth an alternate proposal requesting the department to approve permanent water impoundments, which would also alter the mining plan regarding backfilling and highwall reduction.

The alternate plan suggests diverting runoff water from Miller Coulee and other lesser drainages into the final twenty-four acre pit, thus creating a lake approximately one mile long and 150 feet wide. A permanent overflow channel at the far end would be formed by a submerged road that would allow the water to flow out of the lake into the normal stream channel. The site could be stocked with fish and used as a recreation site in addition to water conservation and irrigation purposes.

Preliminary studies on water quality indicate that perhaps there is some question as to the useability of water which would pass through pits of this kind. As stated in a report done in 1970: "All groundwater and water contained in the pits that was (sic) tested was rather highly mineralized. It is acceptable for human consumption but some getting used to it is necessary. However, according to the lab analyses received on the water samples thus far, the water may have only limited value for irrigation due primarily to high salt hazard. On exposed seepage surfaces and around shrinking pools, an efflorescent coating of salts will always be found."[1] Some of the analyses performed on water samples in the Colstrip area are included in the appendix. Before the alternate proposal could be approved, the department must be assured that the exposed coal seam will be covered and that the water quality (both surficial and groundwater) will not be adversely affected.

V. ADVERSE EFFECTS WHICH CANNOT BE AVOIDED

See analysis.

VI. RELATIONSHIP OF SHORT TERM USES TO LONG TERM PRODUCTIVITY

See analysis.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

See analysis.

VIII. LITERATURE CITED

[1] Toland, Douglas C. 1970 Sedimentary analysis of the Colstrip area mining overburden and cursory groundwater study. Bozeman, Montana 74pp.

Date: August 31,1970

Sample No. · W-10

WATER ANALYSIS

NAME: Douglas Toland

SAMPLE DESCRIPTION: water from western energy pit # 1 swimming area at 8 ft.

LOCATION: Coldstrip

COUNTY AGENT:

COUNTY: Rosebud

ANALYSIS:

Conductivity:	6000	micromhos
Salts (estimated):	3910	parts per million
6.25 59.0 Calcium plus magnesium:	65.25	milliequivalents per liter
Sodium:	14.0	milliequivalents per liter
Other: Iron	3.7	ppm
Sulfate	88.8	milliequivalents per liter
Potassium	.61	milliequivalents per liter
SAR	2.44	

CLASSIFICATION:

Salt hazard:	High
Sodium hazard:	Medium

RECOMMENDATIONS: This water can be used for irrigation under these conditions:

1. Use only on well drained soils of good permeability.
2. Gypsum application may be needed followed by special leaching to remove excess sodium and salt.

This water will present appreciable soduim hazard in soils of high clay content and low organic matter. This water can be used readily on coarse textured soils with good permeability

Date: August 31,1970

Sample No. W-11

WATER ANALYSIS

NAME: Douglas Toland

SAMPLE DESCRIPTION: water from box-end western energy's pit 6. (coal seam seepage)

LOCATION: Coldstrip,Mt.

COUNTY AGENT:

COUNTY: Rosebud

ANALYSIS:

Conductivity: 5000 micromhos

Salts (estimated): 3250 parts per million

9.60 19.75
Calcium plus magnesium: 29.35 milliequivalents per liter

Sodium: 2.75 milliequivalents per liter

Other:
- Iron 4.3 ppm
- sulfate 69.1 milliequivalents per liter.
- potassuim .38 milliequivalents per liter.
- SAR 1.0

CLASSIFICATION:

Salt hazard: High

Sodium hazard: Low

RECOMMENDATIONS: This water can be used for irrigation only on well drained soils of good permeability where special leaching is provided to remove excess salt. Only salt tolerant crops should be grown. There will be little danger of harmful accumulations of sodium.

Date: August 31,1970

Sample No. W-12

WATER ANALYSIS

NAME: Douglas Toland

SAMPLE DESCRIPTION: seepage into box end western energy pit 6
extreme S.E. corner

LOCATION: Coldstrip

COUNTY AGENT:

COUNTY: Rosebud

ANALYSIS:

Conductivity: 4000 micromhos

Salts (estimated): 2590 parts per million

27.75 20.9
Calcium plus magnesium: 48.65 milliequivalents per liter

Sodium: 1.50 milliequivalents per liter

Other:

Iron 14.7 ppm
sulfate 53.9 milliequivalents
potassuim .22 milliequivalents per liter
SAR 0.3

CLASSIFICATION:

Salt hazard: High

Sodium hazard: Low

RECOMMENDATIONS: This water can be used for irrigation only on well drained soils of good permeability where special leaching is provided to remove excess salt. Only salt tolerant crops should be grown. There will be little danger of harmful accumulations of soduim.

Date: August 31,1970

Sample No. W-13

WATER ANALYSIS

NAME:	Douglas Toland
SAMPLE DESCRIPTION:	water sampled from western energy pit 3 (at variable depth)
LOCATION:	Coldstrip,Mt.
COUNTY AGENT:	
COUNTY:	Rosebud

ANALYSIS:

Conductivity:		4000	micromhos
Salts (estimated):		2590	parts per million
21.40 15.16 Calcium plus magnesium:		36.56	milliequivalents per liter
Sodium:		1.85	milliequivalents per liter
Other:	Iron	3.7	ppm
	sulfate	60.08	milliequivalents per liter
	potassuim	.13	milliequivalents per liter
	SAR	0.43	

CLASSIFICATION:

Salt hazard:	High
Sodium hazard:	Low

RECOMMENDATIONS: This water can be used for irrigation only on well drained soils of good permeability where special leaching is provided to remove excess salt. Only salt tolerant crops should be grown. There will be little danger of harmful accumulation of soduim.

Comments have been requested from the following:

Mr. Ed Zaidlicz, State Director
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October 15, 1973

Mr. C. C. McCall
Administrator
Reclamation Division
Department of State Lands
Helena, Montana 59601

Dear Mr. McCall:

The following material is the Environmental Impact Report of the mining permit for 1973-74 and supporting data being submitted on behalf of Peabody Coal Company concerning Area A of the Big Sky Mine at Colstrip, Montana.

Sincerely,

Frank H. Dunkle

Frank H. Dunkle
ENVIRONMENTAL CONSULTANT

FHD:gjt
Enclosure

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FIGURE 1

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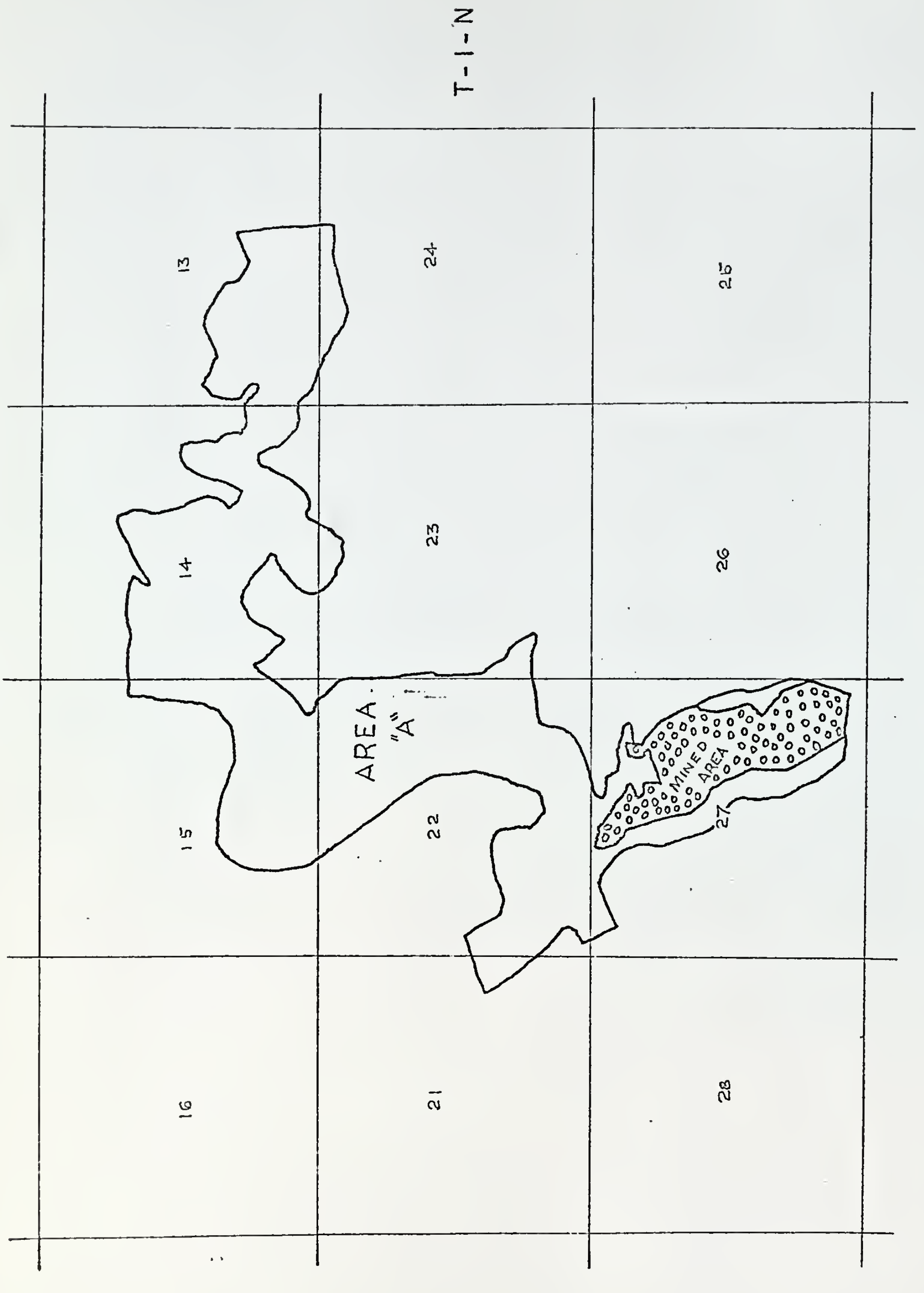
FIGURE 1



PEABODY COAL COMPANY
BIG SKY MINE
AREA "A"
ROSEBUD COUNTY, MONTANA

SECTION I

Introduction

I. INTRODUCTION

1.1 General Description of Application

The Big Sky Mine of Peabody Coal Company is an existing operation in Rosebud County, southwest of Colstrip, Montana, and is located on Sections 13, 14, 15, 21, 22, 23, and 27 in Township 1 North, Range 41 East, known as Area A. A total of 1,424 acres is expected to be disturbed and reclaimed by the surface mining operation during the nine years of mining both the Rosebud and McKay seams (see Figure 1). However, only 339 acres will be disturbed during the period of the permit.

With respect to surface ownership, Peabody Coal Company operates under leases with the Burlington-Northern Railroad and the United States of America, Bureau of Land Management, as well as on some property which the company itself owns. For the mineral rights, the leases are with the Burlington-Northern and the Bureau of Land Management.

The application for a mining permit for Area A was submitted to the Department of State Lands on June 13, 1973, in accordance with the provisions of the Montana Strip Mining and Reclamation Act, Chapter 325, Sessions Laws of Montana, 1973.

Prospecting permit applications, Number 23 and 24, have been applied for on another area, Area B, on which Peabody Coal Company holds additional coal reserves under lease.

1.2 Scope of Report

This report deals with the mining operations, predictable effects, and reclamation plans of the described area. All operations will be done in accordance with state and federal laws and regulations and

State Land Board decisions.

It does not deal with the broad question of the need for energy or the morality of strip mining. These questions are national in character and must be answered by the American people through economic demand and through the democratic processes.

Also, this report does not deal with the philosophical question of which natural resource is the relatively most important for conserving through wise management. State mining laws and regulations are directed toward properly protecting the land surface of the area and reclaiming it as nearly as possible to its natural character. However, the federal Coal Conservation Act is directed toward the least possible waste of the coal resource. State law and regulations are, at times, in conflict with the federal act. In these instances, Peabody Coal Company will ask the state for a decision on each particular case.

1.3 Summary

The area which the Big Sky Mine encompasses was used as range land and wildlife habitat prior to mining. Reclamation will allow it to return to these same land uses at the conclusion of mining in approximately 11 to 12 years. Approximately 339 acres of the total 1,424 acres to be mined will be disturbed during the first permit period.

The mine will provide additional income to the area in the form of wages and taxes; however, additional social services will be required for an increased work force.

Environmental impacts from dust and water pollution will be

mitigated by methods described in this report and will be within legal requirements established by state and federal laws. An inventory of fauna and flora of the area has been made and studies are determining the effectiveness of various reclamation methods and procedures.

Aesthetics of the area will be adversely effected during mining operations but should be reduced considerably after reclamation. The only permanent effect on the land face will be a change in the contour.

Archeological findings in the area have been explored and salvaged by authorities from University of Montana.

1.4 Background

The Big Sky Mine began full production in September, 1969 under a voluntary contract with the Montana Bureau of Mines, dated February 18, 1969 in accordance with Section 50-1001 and 50-1017 RCM, 1947. Acquisition of the coal reserves began in 1966. With a sufficient quantity of coal reserves was leased from federal and private ownership, adequate to negotiate a long-term contract with an electric utility company, negotiations began in mid-1967 with Minnesota Power and Light Company.

During the mid-1960's Minnesota Power and Light Company began a study to locate low-cost, long-term coal supplies from the states of North Dakota, Montana, and Wyoming, which could be used by existing coal fired equipment. The study was a result of increased coal costs and transportation charges from the eastern coal fields, which had historically supplied the area. During this study, Minnesota Power and Light Company visited with several coal producers and railroads, and employed the services of outside consultants familiar with the problem.

The negotiations with Peabody Coal Company centered upon the reserves located in the Colstrip area. These discussions resulted in contractual negotiations early in 1968, on July 29, 1968 a 20-year contract was signed which initiated the first long-term movement of western coal into the midwestern and eastern coal markets.

In the fall of 1968, Peabody Coal Company provided Minnesota Power and Light Company with 41,000 tons of coal from a test pit in the proposed mining area. Actual mining at the Big Sky Mine began in September, 1969, and has continued on an accelerated basis. Current shipments are at the rate of 160,000 tons per month. The contractual schedule calls for an increase in the late summer of 1974 to an annual production of 2.5 million tons, which is the specified rate of shipment for the balance of the contract life. In addition, some shipments are made to other utility companies outside of Montana for test purposes or on short-term contracts. This year, 100,000 tons are being supplied to Northern States Power Company's generating stations in the Minneapolis area.

Annual production at Big Sky has been as follows:

YEAR	TONNAGE
1969	163,769
1970	1,437,955
1971	1,495,043
1972	1,601,180
1973	1,480,597

1.5 Expansion

Increased production is planned for the Big Sky Mine in mid-1974.

The projected tonnage increase will provide an annual production of 3.5 million tons. At the present time, a second mining machine, a Marion 7800 dragline with 30 cubic yard capacity bucket, is being erected to furnish the increased tonnage requirements of the Minnesota Power and Light Company contract. The mine capacity will then provide an additional 1 million tons per year for sale to other utility companies. As yet no contract has been signed for this additional production.

Construction of a rapid loading facility will be completed in the late fall of 1973 to permit the loading of a 10,000-ton unit-train in a period of four hours. The facility will be available for loading on a 24-hour basis, 7 days a week.

1.6 Reclamation

1.61 Existing Projects

In 1969, the Peabody Coal Company contracted with the Montana Agricultural Experiment Station at Montana State University for experimental work in reclamation. This first work, which is an on-going project, was conducted on a railroad cut because of the lack of spoils at that time. Experiments have been conducted to examine the following items: species adaptation, fertilizer needs and tillage practices. Hydrology studies are being done in the area to determine the effects of mining and any potential problems of maintaining groundwater levels.

Actual reclamation work began in 1970 with the grading and

seeding of the small area then disturbed. At that time, along with the seeding of grasses and legumes, more than 1500 trees and shrubs were planted. An equal number of trees and shrubs have been planted each year, and special equipment has been acquired for the removal and replacement of topsoil. The methods of grading and planting have improved each year, utilizing information developed on the experimental areas. This year native aquatic species were transplanted into the ponds including cattails, various reeds, frogs, salamanders, and snails. These were gathered from sites in the area and transplanted by hand.

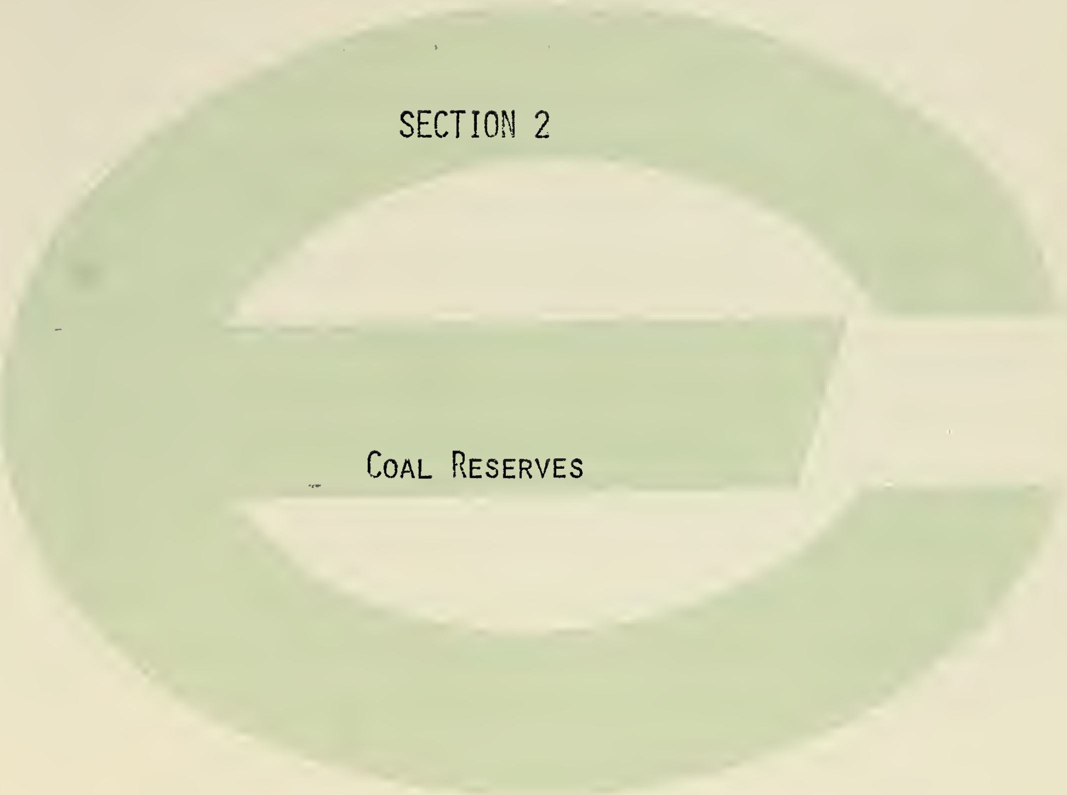
Since mining operations began, the mined areas have been at some stage of reclamation--awaiting replacement, topsoiling, grading, or seeding.

1.62 Results:

Since these reclamation efforts have largely been experimental due to the lack of information associated with the spoils area, the results have been somewhat inconsistent with expectations. Many trees and shrubs were dug locally by Peabody Coal Company personnel and transplanted to the reclamation sites. The 1971 season was unusually dry following planting and seeding and, on other sites, it was determined the area should be regraded and other types of reclamation attempted.

The following is a list of the tree and shrub species planted, the year and number planted and their survival where determined.

Caragana	*Caragana arborescens*	1970	1300	86%
Russian Olive	*Elaeagnus angustifolia*	1972	1500	73.5%
Buffalo Berry	*Shepherdia argentia*	1973	1000	unknown
Green Ash	*Fraxinus pennsylvanica*	1970	200	90%
		1972	200	90%
Cottonwood	*Populus deltoides*	1971	100	unknown
		1972	100	unknown
		1973	100	unknown
Chinese Elm	*Ulmus parvifolia*	1970	20	unknown
		1971	20	unknown
		1972	20	unknown
Black Locust	*Robinia pseudoacacia*	1972	50	unknown
Ponderosa Pine	*Pinus ponderosa*	1973	500	less than 20%
Rocky Mountain Juniper	*Juniperus scopulorum*	1973	250	less than 5%
Skunkbush Sumac	*Rhus trilobata*	1972	50	unknown
Virginia Creeper	*Parthenocissus* spp.	1972	50	unknown
		1972	1000	less than 20%
Autumn Olive	*Angustifolia* spp.	1973	1000	less than 20%
Cattail	*Typha* spp.	1973	200	83%



SECTION 2

COAL RESERVES

2. COAL RESERVES

2.1 Tonnage

Area A contains 34,325,000 tons of coal in the Rosebud seam and 8,300,000 tons in the McKay seam. These tonnages are recoverable with present mining plans by digging to a total overburden depth of 100 feet over each seam; that is, to 100 feet total over the McKay seam, then continuing on with the Rosebud seam until a depth of 100 feet is reached. These figures constitute the maximum amount of coal recoverable. The actual amount recovered will depend upon decisions made by the state in specific problem cases such as regulations regarding ramp roads and buffer zones.

2.2 Description of Seams

The uppermost seam present to be mined in this operation is the Rosebud seam. The Rosebud seam is approximately 25 feet thick, is sub-bituminous in nature and quality, and will underlay all of the mining area except that portion where the McKay seam crop line extends out beyond the Rosebud crop line.

The other mineable seam is the McKay seam. The McKay seam lies under the Rosebud seam and is separated by a shale parting varying in thickness from eighteen (18) to thirty-five (35) feet thick. McKay seam is also a sub-bituminous coal in nature and in quality and averages about eight (8) feet in thickness. The McKay seam will underlay the entire mining area since its crop line is the outside limit of the mining operation.

2.3 Analyses of Seams

Big Sky coal is a sub-bituminous, low sulfur, medium ash coal. Complete analytical data for the Rosebud seam was first obtained from early shipments for test purposes to Minnesota Power and Light Company. Another sample collected at Cohasset Station from unit train shipments in the spring of 1970 was completely analyzed. The results of these investigations are shown in Table 1. The analytical work was performed by Commercial Testing and Engineering Company on samples collected at Minnesota Power and Light Company.

Analytical information from core drilling of the McKay seam shows that it is similar in characteristics to the Rosebud, but a little higher in sulfur. (See Table 1 and 2.)

A typical analysis from 100 cores and actual production is shown in Table 2.

Both seams are shipped to Minnesota Power and Light Company but not blended for shipping. Whichever pit is being loaded determines the coal placed in railroad cars after crushing. The coal from each shipment is routinely sampled by a mechanical sampler at the generating station and analyzed for short proximate analysis. The average for these shipments is shown in Table 3.

2.4 Trace Elements in Coal

Various trace elements in coal from both the Rosebud and McKay seams, have been analyzed by the Illinois State Geological Survey, Ledgemont Laboratory of Kennecott Copper Corporation, Bituminous Coal Research, Peabody Coal Company's Central Laboratory, and the United States Geological Survey. The analytical results from these laboratories are shown in Tables 4 and 5.

It should be noted when reviewing this data that there are no American Society for Testing and Materials (ASTUM) standards for analytical techniques to determine trace elements in coal. The interest and concern in these elements are of recent origin. Various analytical techniques are being investigated and reported in the literature as indicated in Appendix 1. Personnel from Peabody's Central Laboratory at Freeburg, Illinois are participating in the ASTM task group currently developing standardized methods for determining various trace elements in coal. Laboratory personnel are also participants in a round robin analytical program being conducted by the Federal EPA, National Environmental Research Center and the U. S. Bureau of Standards. This group is conducting studies of various analytical techniques utilizing participation by governmental, commercial, and private laboratories.

Therefore, the analytical results displayed in the above mentioned tables should not be considered as precise values, but rather as a range showing the order of magnitude. Variations in the order of ± 100% may not be uncommon with the infancy of techniques, sensitivity of instrumentation, and minute quantities involved.

Another problem regarding trace elements is the fact that there is not universal agreement concerning which elements have an adverse effect on the environment, thus which elements should be identified and analyzed.

With respect to the environmental impact of trace elements in coal from an air pollution standpoint in Montana, there is no effect since the coal is not currently being burned in this state. The state which does burn it, Minnesota, does not have a regulatory requirement concerning trace elements. Because of the lack of technology

available for measuring such emissions, and their effects at given levels, guidelines have not been established regarding any potential problems associated with trace elements in the burning of coal.

2.5 Core Drilling Program

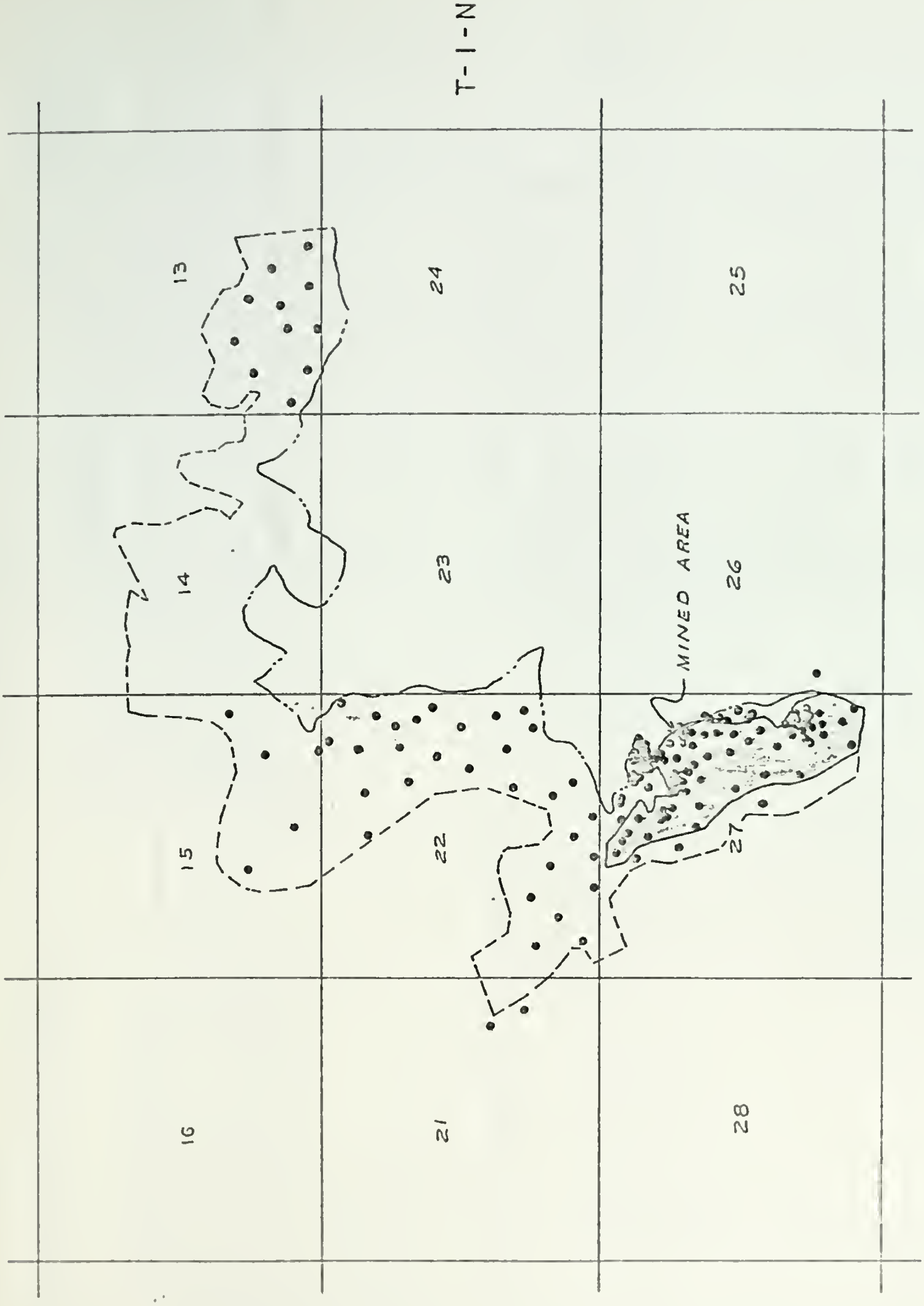
Area A of the Big Sky Mine has been prospected and drilled in a drilling program of 138 core holes. All other drilling in this area was done with either fish tail bits or tri-cone bits. Their purpose was to determine the location of the cost and its thickness and not necessarily its quality. (See Figure 2, with all core holes locations marked.)

2.6 Expected Life of Mine

It is anticipated that Area A will supply the coal demand for this mine for nine years under the present mining plans and coal supply agreements.

See Section 2.5
Core Drilling Program--page 12

FIGURE 2



PEABODY COAL COMPANY
BIG SKY MINE
AREA "A" - CORE HOLES
ROSEBUD COUNTY, MONTANA

See Section 2.3
Analyses of Seams--page 10

Summary of C.T. E. Co. Analyses

TABLE 1
PEABODY COAL COMPANY

Seam Rosebud Seam - RAW

Mine BIG SKY
Montana

	Date Sampled	Sample Identification	C.T.&E. No.	As Received				Dry Basis					
				Moist	Ash	Sul	Btu	Ash	Vol	F.C.	Sul	Btu	MAF Btu
1	1968	Minnesota Power & Light Company	CH368791	25.53	8.09	0.71	8362	10.86	41.54	47.60	0.95	11229	1259
2	1968	Minnesota Power & Light Company	CH368792	24.07	8.04	0.77	9020	10.59	40.58	48.83	1.01	11880	1314
3	3/70 & 4/70	Clay Boswell SE Station	CH382277	25.88	9.09	0.79	8497	12.26	39.55	48.19	1.07	11464	1306
4													
5													
6													
7													
8													

	Sul. Forms - Dry			Ultimate - Dry Coal						Mineral Analysis of Dry Ash										
	Pyrit.	Sulfate	Org.	C	H	N	Cl	S	O	P_2O_5	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	CaO	MgO	SO_3	K_2O	Na_2O	Undetermined
1	0.34	0.09	0.52	66.86	4.33	0.73	0.01	0.95	16.26	0.13	46.39	9.39	17.87	0.97	9.02	4.02	10.34	0.39	0.53	0.
2	0.30	0.00	0.71	69.11	4.66	0.76	0.01	1.01	13.86	0.24	43.17	7.42	19.63	0.88	11.08	4.32	10.98	0.51	0.41	0.6
3	0.30	0.23	0.26	66.06	4.75	0.75	0.02	1.07	15.09	0.14	47.43	6.93	18.30	1.04	9.60	3.70	10.91	0.76	0.36	0.
4																				
5																				
6																				
7																				
8																				

	ASH FUSION - Reducing				ASH FUSION - Oxidizing				Grind Index	F.S.I	Alk coal	Eq. Moist	Slag Vis. 250P@	$\frac{Fe_2O_3}{CaO+MgO}$		$\frac{Base}{Acid}$	Water Sol.		Alk.	#As MBt
	Init	Soft H=W	Soft H=½W	Fluid	Init	Soft H=W	Soft H=½W	Fluid									Na_2O	K_2O		
1	2190	2360	2380	2475	2300	2470	2500	2630	57.3	0	.09	23.78	2540	7.20		.36	.033	.001		9.6
2	2190	2380	2400	2530	2280	2480	2510	2580	48.4	0	.08	23.30	2540	4.82		.36	.024	.001		8.91
3	2060	2200	2220	2320	2140	2230	2250	2340	40.7	0	.11	23.04	2520	5.21		.32	.014	.001		10.6
4																				

See Section 2.3
Analyses of Seams--page 10

TABLE 2

PEABODY COAL COMPANY
BIG SKY MINE

TYPICAL ANALYSIS BASED UPON CORES DRILLED THROUGH OCTOBER 1968-ANALYSES BY PEABODY COAL COMPANY CENTRAL LABORATORY - MC KAY SEAM

	AS RECEIVED	DRY BASIS
PROXIMATE ANALYSIS		
Moisture	27.50%	xxx
Ash	8.42%	11.61%
Volatile	28.68%	39.56%
Fixed Carbon	35.40%	48.83%
Btu	8,319	11,474
Sulfur	1.52%	2.10%
M & AF Btu	12,937	
SULFUR FORMS		
% Pyritic	1.05%	1.45%
Sulfate	.03%	.04%
Organic	.44%	.61%
WATER SOLUBLE MOISTURE		
% Na_2O	.025%	
% K_2O	.002%	
EQUILIBRIUM MOISTURE	25.50%	
ASH FUSION (Reducing)(Given in Degrees Fahrenheit)		
Initial Deformation (ID)	2,047	
Spherical (H=W)	2,170	
Hemi-spherical (H=1/2 W)	2,188	
Fluid (FT)	2,273	
ASH FUSION (Oxidizing)(Given in Degrees Fahrenheit)		
Initial Deformation (ID)	2,180	
Spherical (H=W)	2,348	
Hemi-spherical (H=½W)	2,371	
Fluid (FT)	2,431	
HARDGROVE GRINDABILITY	49.3	
ULTIMATE ANALYSIS		
Carbon		68.10%
Hydrogen		4.18%
Nitrogen		.72%
Chlorine		.10%
Sulfur		2.10%
Ash		11.30%
Oxygen (Diff)		13.50%

Table 2 (continued)

MINERAL ANALYSIS OF ASH

P_2O_5	.09%
SiO_2	36.11%
Fe_2O_3	17.94%
Al_2O_3	17.78%
TiO_2	.60%
CaO	12.14%
MgO	4.35%
SO_3	10.16%
K_2O	.49%
Na_2O	.34%
Undetermined	-0- %
ALKALIES AS Na_2O	.07%

See Section 2.3
Analyses of Seams--page 10

TABLE 3

AVERAGE ANALYSIS OF BIG SKY COAL SAMPLED AND ANALYZED BY MINNESOTA POWER AND LIGHT COMPANY--GIVEN AS PERCENT BY WEIGHT EXCEPT BTU*

	AS RECEIVED				DRY BASIS			M & AF
YEAR	MOIST.	ASH	SULFUR	BTU	ASH	SULFUR	BTU	BTU
1970	26.13	10.03	.81	8462	13.58	1.10	11455	13255
1971	26.32	9.73	.91	8480	13.20	1.23	11509	13259
1972	26.47	9.43	.94	8522	12.82	1.28	11590	13294
1973 (First 6 months)	25.39	9.34	1.00	8632	12.52	1.34	11570	13226

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*British Thermal Unit

See Section 2.4
Trace Elements in Coal--page 10

TABLE 4

TRACE ELEMENT ANALYSES OF PEABODY COAL CO. BIG SKY MINE ROSEBUD COUNTY, MONTANA

(ALL VALUES IN PPM)

ELEMENT	LEDGEMONT		ILL. GEOL. SURVEY		PEABODY C.C.	BIT. COAL RES.	
	#43	#2	#C-17046	C-17047	#3-1551-R		
	Rosebud	McKay	Rosebud	McKay	Rosebud	Rosebud	McKay
Hg	0.063	0.100	0.09	0.07	.091	0.04	0.04
Sb	----	----	0.9	0.9	1.3	--	--
Se	----	----	0.83	0.76	---	--	--
As	----	----	1.3	2.5	2.6	--	--
Ga	----	----	3.5	3.4	---	--	--
Mn	179	137	101	88	138	--	--
B	74	----	92	84	222	--	--
Br	----	----	20	20	---	--	--
Cd	0.6	0.6	0.4	0.4	---	--	--
P	----	----	48	38	---	--	--
Mo	----	----	30	8.2	---	--	--
Zr	----	----	169	---	---	--	--
Be	0.4	1.0	1.0	1.1	0.5	--	--
Ge	----	----	2.7	2.4	---	--	--
V	10	10	14	14	11.7	--	--
Pb	8	2	7	7	1	--	--
Ni	4	9	6	6	9	--	--
Cu	12	17	16	15	12	--	--
Zn	7	6	21	10	5	--	--
Cr	6	5	5.3	5.8	20	--	--
Co	----	94	2	2.1	---	--	--
F	----	----	---	52	214	--	--
Li	9.5	6.8	---	---	14.6	--	--
Ag	0.40	----	---	---	.16	--	--

Table 5.--Proximate, ultimate, Btu, and sulfur analyses of eight samples of the Rosebud coal bed and one sample of the McKay coal bed from the Big Sky Mine, Rosebud County, near Colstrip, Montana. All analyses, except Btu, in percent. (Original moisture content of samples may be slightly more than shown because samples were collected and transported in plastic bags to avoid metal contamination.)

SBM Lab. No.:	K-24781 (USGS No. D163179)			K-24782 (USGS No. D163180)			K-24783 (USGS No. D163181)			K-24784 (USGS No. D163182)		
	As received	Moisture free	Moisture and ash free	As received	Moisture free	Moisture and ash free	As received	Moisture free	Moisture and ash free	As received	Moisture free	Moisture and ash free
oisture	19.8	--	--	20.2	--	--	20.7	--	--	19.1	--	--
ol. matter	29.5	36.7	40.5	31.4	39.4	44.0	30.9	39.0	42.8	29.7	36.6	41.3
ixed carbon	43.3	54.1	59.5	40.1	50.2	56.0	41.4	52.2	57.2	42.2	52.2	58.7
sh	7.4	9.2	--	8.3	10.4	--	7.0	8.8	--	9.0	11.2	--
ydrogen	5.8	4.5	5.0	6.1	4.9	5.4	6.1	4.8	5.3	5.7	4.4	5.0
arbon	56.0	69.8	76.9	55.1	69.0	77.0	55.2	69.7	76.4	54.6	67.5	76.0
itrogen	.9	1.1	1.2	.8	1.0	1.1	.8	1.0	1.1	.8	1.0	1.1
xygen	29.4	14.8	16.2	29.1	14.0	15.7	30.3	14.9	16.3	29.2	15.0	16.9
ulfur	.5	.6	.7	.6	.7	.8	.6	.8	.9	.7	.9	1.0
sh	7.4	9.2	--	8.3	10.4	--	7.0	8.8	--	9.0	11.2	--
tu	9,550	11,910	13,120	9,550	11,960	13,350	9,610	12,120	13,290	9,510	11,750	13,230
orms of sulfur												
Sulfate	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Pyritic	.11	.14	.15	.26	.33	.36	.30	.38	.39	.49	.61	.68
Organic	.36	.45	.49	.30	.38	.42	.31	.39	.43	.21	.26	.29
ample description	Channel sample, 0-6.8 ft from top of Rosebud coal bed			Channel sample, 6.8-12.5 ft from top of Rosebud coal bed			Channel sample, 12.5-17.5 ft from top of Rosebud coal bed			Channel sample, 17.5-22.5 ft from top of Rosebud coal bed		

SBM Lab. No.:	K-24785 (USGS No. D163183)			K-24786 (USGS No. D163184)			K-24788 (USGS No. D163187)			K-24787 (USGS No. D163186)		
	As received	Moisture free	Moisture and ash free	As received	Moisture free	Moisture and ash free	As received	Moisture free	Moisture and ash free	As received	Moisture free	Moisture and ash free
oisture	23.0	--	--	22.4	--	--	16.4	--	--	19.7	--	--
ol. matter	29.6	38.4	40.6	29.5	38.0	41.9	30.4	36.4	41.2	27.5	34.3	37.3
ixed carbon	43.1	56.0	59.4	40.9	52.7	58.1	43.5	52.0	58.8	46.3	57.7	62.7
sh	4.3	5.6	--	7.2	9.3	--	9.7	11.6	--	6.5	8.0	--
drogen	6.2	4.8	5.0	6.2	4.8	5.3	5.6	4.5	5.1	5.5	4.2	4.5
rbon	55.8	72.4	76.7	53.4	68.7	75.8	56.5	67.6	76.5	56.4	70.2	76.4
itrogen	.8	1.0	1.1	.8	1.1	1.2	.8	1.0	1.1	.8	.9	1.1
ygen	32.3	15.4	16.3	31.5	14.9	16.4	26.5	14.3	16.1	30.4	16.2	17.5
lfur	.6	.8	.9	.9	1.2	1.3	.9	1.0	1.2	.4	.5	.5
h	4.3	5.6	--	7.2	9.3	--	9.7	11.6	--	6.5	8.0	--
u	9,650	12,530	13,260	9,280	11,960	13,190	9,720	11,630	13,150	9,380	11,690	12,710
rms of sulfur												
ulfate	0.01	0.01	0.01	0.02	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01
yritic	.25	.32	.34	.51	.66	.72	.56	.67	.76	.09	.11	.12
rganic	.38	.49	.52	.37	.50	.55	.29	.35	.39	.28	.35	.38
mple scription	Channel sample, 22.5-24.6 ft from top of Rosebud coal bed			Channel sample, 25.1-27.6 ft from top of Rosebud coal bed			Tipple sample, Rosebud coal bed			Channel sample, 0-5.4 ft from top of McKay coal bed		

Table 5.--Quantitative values (in ppm) for 11 trace elements in 14 samples of the Rosebud and McKay coal beds and associated rocks, collected July 27, 1973 at the Big Sky Mine, Rosebud County, near Colstrip, Montana. Values listed for Cd, Cu, Li, Pb, and Zn in coal samples have been recalculated from analyses on ash of coal.

Sample No.	Sample description	Sample interval	As	Cd	Cu	F	Hg	Li	Pb	Sb	Se	U	Zn	% As
		OVERBURDEN ROCK, ROSEBUD COAL BED												
D163191	Sandstone	(Grab sample, 4.0 ft above coal)	4	<1	36	700	0.04	24	30	0.7	0.3		61	--
D163190	Sandstone	0.4-1.0 ft above coal	3	<1	16	400	.02	18	<25	.7	1.1		42	--
D163189	Claystone	0-.4 ft above coal	4	<1	48	1000	.05	42	40	1.1	1.1		76	--
		ROSEBUD COAL BED												
D163179	Coal	0-6.8 ft from top of coal	1	<0.1	7.6	105	0.04	12	6.0	0.3	0.7		1.9	9.1
D163180	Coal	6.8-12.5 ft from top of coal	1	< .1	6.2	<20	.03	18	5.9	.3	.2		2.4	9.8
D163181	Coal	12.5-17.5 ft from top of coal	1	< .1	6.5	<20	.06	13	5.0	.2	.2		2.6	8.2
D163182	Coal	17.5-22.5 ft from top of coal	1	< .1	8.7	40	.08	10	5.6	.3	.8		3.0	10.2
D163183	Coal	22.5-24.6 ft from top of coal	1	< .1	3.6	<20	.06	3.7	3.0	.4	.8		2.0	5.0
D163192	Claystone and coal	24.6-25.1 ft from top of coal	2	< .1	43.	100	.05	122	36.	.5	2.4		23.	51.7
D163184	Coal	25.1-27.6 ft from top of coal	2	.1	7.0	20	.14	8.9	6.4	.5	.8		3.1	9.1
		UNDERLYING ROCK, ROSEBUD COAL BED												
D163193	Shale, pyritic	0-.2 ft below coal	20	<1	42	900	0.44	34	40	4.3	2.1		58	--
		SPECIAL SAMPLES, ROSEBUD COAL BED												
D163188	Claystone	0.1 ft parting (base of D163180)	1	<1	15.	600	0.02	18	<25.0	0.6	<0.1		9.0	--
D163185[1]	Coal, pyritic	0.15 ft (base of D163184)	15	< .1	11.	50	.63	< 1	7.9	.9	1.3		11.	26.3
D163187	Coal	Tipple sample of coal shipped	2	< .1	7.7	60	.07	14	7.5	.5	.5		5.4	11.5
		OVERBURDEN ROCK, COAL, AND UNDERLYING ROCK, McKAY COAL BED												
D163195	Sandstone	(Grab sample, 6 ft above coal)	8	<1	26.	700	0.04	22	35.0	0.8	0.4		44.0	--
D163186	Coal	Upper 5.4 ft, slightly weathered	1	< .1	4.6	70	.05	6.6	5.4	2.7	.4		2.5	7.1
D163194	Shale, carbonaceous	0-.3 ft below coal	4	< .1	74.	300	.20	39	46.	2.2	3.6		58.	54.2

[1] Based on analysis of 11.4 percent total sulfur, sample contains about 21 percent pyrite.

Table 5.--Semiquantitative spectrographic analyses (in ppm) of the samples from the Rosebud and McKay coal beds and associated rocks, Big Sky Mine. All values listed for coal samples have been recalculated from analyses on ash of coal.

Sample No.	Sample description	B	Ba	Be	Co	Cr	Ga	La	Mn	Mo	Nb	Ni	Sc	Sr	Ti	V	Y	Yb	Z
OVERBURDEN ROCK, ROSEBUD COAL BED																			
D163191	Sandstone	30	500	<1.5	7	70	15	<50	150	<3	<10	15	10	100	2000	70	15	2	15
D163190	Sandstone	30	300	<1.5	5	30	10	<50	70	<3	<10	7	7	50	1500	50	15	2	20
D163189[1]	Claystone	50	700	2	7	70	20	70	70	3	15	15	15	100	3000	150	15	3	15
ROSEBUD COAL BED																			
D163179	Coal	70	700	0.7	<0.5	5	3	7	50	10	<1	1.5	1.5	300	300	7	3	0.3	3
D163180	Coal	70	150	<.15	<.5	5	3	7	70	2	2	1.5	1.5	200	300	7	3	.3	2
D163181	Coal	50	150	<.15	<.5	5	2	5	20	1.5	<1	1	1	70	200	5	2	.2	1
D163182	Coal	50	150	<.15	<.5	3	3	<5	30	3	<1	1	1.5	100	300	7	3	.3	3
D163183	Coal	70	100	.15	.5	1.5	3	5	50	5	<1	1.5	1	70	150	5	3	.15	1
D163192	Claystone and coal	30	70	<.15	<.5	15	15	<5	70	5	<1	<3	<3	70	3000	30	10	1	15
D163184	Coal	70	100	.7	<.5	2	5	7	70	3	5	1.5	2	100	300	7	5	.3	2
UNDERLYING ROCK, ROSEBUD COAL BED																			
D163193	Shale, pyritic	50	300	1.5	10	30	15	<50	50	<3	<10	30	7	50	1500	70	15	--	5
SPECIAL SAMPLES, ROSEBUD COAL BED																			
D163188[1]	Claystone	70	500	1.5	<5	20	10	70	30	15	15	3	10	100	3000	50	20	3	15
D163185	Coal, pyritic	30	2000	3	<.5	2	--	<5	20	15	<1	3	3	30	70	5	7	--	
D163187	Coal	50	500	.5	1	3	3	<5	30	7	1.5	3	1.5	150	300	7	2	.3	2
OVERBURDEN ROCK, COAL, AND UNDERLYING ROCK, McKAY COAL BED																			
D163195	Sandstone	30	300	<1.5	5	30	10	<5	300	<3	<10	10	7	100	1000	50	15	1.5	15
D163186[2]	Coal	70	200	1	<.5	2	2	5	15	.7	1	2	1	200	150	5	3	.3	1
D163194	Shale, carbonaceous	50	150	7	<.5	30	10	<5	30	3	10	3	10	300	3000	50	30	3	15

[1] Sample also contains 150 ppm Ce and 70 ppm Nd.

[2] Sample also contains 2 ppm Ge.

Table . --Major oxide composition (in percent) of the ash of eight coal samples from the Rosebud bed and one coal sample from the McKay bed, and of the rocks associated with each coal bed, collected July 27, 1973, at the Big Sky Mine, Rosebud County, near Colstrip, Montana.

Sample No.	Sample description	Ash	SiO_2	Al_2O_3	Na_2O	K_2O	CaO	MgO	P_2O_5	Fe_2O_3	SO_3
	CHANNEL SAMPLES, ROSEBUD COAL BED										
D163179	0-6.8 ft from top of coal	9.17	48.	16.	0.33	<0.1	9.3	4.6	0.10	1.8	13.
D163180	6.8-12.5 ft from top of coal	9.84	49.	16.	.34	.5	8.8	3.9	.18	2.5	12.
D163181	12.5-17.5 ft from top of coal	8.28	39.	15.	.21	.1	9.7	4.2	.27	5.0	17.
D163182	17.5-22.5 ft from top of coal	10.2	45.	12.	.21	<.1	8.3	3.4	.67	7.7	15.
D163183	22.5-24.6 ft from top of coal	5.01	22.	15.	.42	.1	13.5	6.0	.22	5.3	23.
D163184	25.1-27.6 ft from top of coal	9.11	31.	21.	.22	.1	7.5	3.5	<.05	10.	15.
	SPECIAL SAMPLES, ROSEBUD COAL BED										
D163185	0.15 ft (base of D163184)	26.3	< 1.	2.6	0.07	0.3	1.4	0.75	<0.05	77.	5.2
D163187	Tipple sample	11.5	53.	15.	.37	.8	7.6	3.7	.26	5.4	12.
	CHANNEL SAMPLE, McKAY COAL BED										
D163186	Upper 5.4 ft	7.18	32.	18.	0.38	<0.1	12.	5.3	<0.05	6.7	17.
	ROCKS ASSOCIATED WITH ROSEBUD COAL BED										
D163191	Sandstones, 4.0 ft above coal	--	70.	10.	0.57	2.4	4.3	4.1	0.21	2.0	<0.1
D163190	Sandstone, 0.4-1.0 ft above coal	--	77.	7.6	.49	1.9	2.8	2.8	.20	1.6	.6
D163189	Claystone, 0-.4 ft above coal	--	72.	14.	.54	4.0	.2	1.9	.13	3.5	1.1
D163188	Claystone, 0.15 ft, in coal bed	--	61.	8.2	.08	2.8	.3	.43	<.05	1.0	.4
D163192	Claystone, 0.5 ft, in coal bed	(51.7)	37.	13.	.10	< .1	.5	.55	<.05	.2	.5
D163193	Shale, 0-.2 ft below coal	--	44.	10.	.09	3.1	.2	1.6	.10	16.	28.
	ROCKS ASSOCIATED WITH McKAY COAL BED										
D163195	Sandstone, 6 ft above coal	--	72.	8.0	0.57	2.1	8.2	4.7	0.11	2.6	0.3
D163194	Shale, 0-.3 ft below coal	(54.2)	40.	9.4	.17	.8	.6	1.3	< .05	1.0	.5

Table 5

Acknowledgments, chemical analyses:

The standard coal analyses reported in table were made by the Coal Analysis Section (F. E. Walker, chemist-in-charge), U.S. Bureau of Mines, Pittsburgh, Pa.

All other analyses were made by the U.S. Geological Survey, Denver, Colo. The analysts were P. J. Aruscavage, E. J. Fennelly, J. Gardner, W. D. Goss, J. C. Hamilton, A. W. Haubert, C. Huffman, Jr., V. M. Merritt, H. T. Millard, J. Moreland, D. R. Norton, R. A. Rahill, V. E. Shaw, J. A. Thomas, J. S. Wahlberg, T. L. Yager, and R. J. Young.

The 17 samples were collected by W. J. Mapel, E. R. Landis, E. M. Schell, and W. C. Culbertson. The analytical study was coordinated by V. E. Swanson.

SECTION 3

MINING PLAN

3. MINING PLAN

3.1 Basic Operation

In the surface mining operation, the first step is to remove the material overlaying the coal and place it on the ground alongside. As the resulting pit is lengthened, a section of exposed coal is ready for the loading with an electrically powered shovel. The coal is loaded into large off-highway trucks for transporting over company-built, private roads to the crushing and loading facility where it is placed in railroad cars for shipment to the customer.

Once the pit has been extended the desired length, up to a mile at the Big Sky Mine, the overburden machine reverses direction placing the material from the second cut in the hole left from the prior cut. Thus a series of ridges results until grading for reclamation begins. In compliance with state regulations, no more than two ridges will be ungraded at any one time.

3.2 Map

A map of the area to be mined accompanies this report. (See Figure 3.) On the map, the areas planned to be mined are marked and the sequence in which they will be mined is indicated by the numbered years. This sequence is subject to slight alterations as mining progresses, but in general it shows the contemplated action.

3.3 Mining Equipment

At the present time, mining is being done with a 7400 Marion Power Shovel Company dragline equipped with a 175 foot boom and a 14

yard bucket. This machine has, to date, done all of the overburden removal including the parting over the McKay seam. However, there is another machine under construction which will become the primary overburden machine in February 1974. This machine is a 7800 Marion dragline equipped with a 200 foot boom and a 30 cubic yard bucket. When the new machine goes into operation, the 7400 dragline will then serve as the parting machine to uncover the McKay seam where it is to be mined in a single seam operation. The 7400 will also be used, when available, to supplement the reclamation equipment.

Coal is removed from the seam by a 191 M Marion loading shovel equipped with a 15 yard bucket. Loading is sometimes supplemented by the use of a 988 Caterpillar front-end loader. The coal, when removed from the seam, is loaded into four 120 ton off-highway type trucks which carry the coal to the processing plant for preparation and loading into railroad cars.

3.4 Typical Pit and Spoils

Figure 4 shows a typical cross-section overburden removal and spoil placement when using the 7800 dragline and a dozer. Figure 5 shows operations using the 7800 to remove overburden and the 7400 to aid spoil placement. Both Figures show regraded spoils.

3.5 Auxiliary Services

3.51 Access:

Access to the Big Sky Mine, other than by rail, is afforded by a gravel road constructed by Peabody Coal Company for

the sole purpose of gaining access to the mining area and its support facilities. This road is connected to Montana State Highway 315 at a point approximately seven miles south of the town of Colstrip, Montana, located in Rosebud County.

3.52 Haulage Roads:

Haulage roads which accommodate the off-highway trucks are built by mine equipment or contracted and built to Peabody Coal Company engineering specifications and in conformance with state regulations. These roads normally have a sub-grade which consists of three to four feet of shale obtained from the mining pit, placed and compacted to support the loads imposed by the large trucks and other equipment which use them.

The roads are surfaced with four to six inches of crushed "scoria", a native aggregate available in many locations about the mine, which has been crushed to the desired size by a company-owned crushing plant. When weather conditions demand, the running surface of the roads is sprayed with water to reduce the dust created by the haulage truck traffic.

In the construction of the haulage roads, attention is given to sizing and installing drainage culverts to handle any surface water with a course that intersects the road in accordance with the law.

3.53 Storage Facilities:

At the present time, the only storage facility at the mine is a 300 ton truck dump hopper and a small run-of-mine raw coal

stockpile alongside the truck hopper, which contains about 10,000 tons of coal. Coal from the raw coal stockpile is fed into the truck hopper and supplements the coal hauled by the trucks in order to load the railroad cars within the required 24-hour period. (See Figure 6.)

A storage facility capable of holding 24,000 tons is presently under construction. This storage pile will be completely enclosed and is equipped with a recovery system capable of loading a "unit train" in less than four hours. The new system is scheduled to be operational about January 1974. (See Figure 7.)

3.54 Loading Facilities:

At the present time, the loading facilities consist of a chute directly under the crushing and sizing equipment. Railroad cars are pulled by a "dummy car" connected with a cable to a car mover which moves the cars under the loading chute one at a time for loading. (See Figure 6.)

When the new system, described in above section, is operational in January 1974, coal will be reclaimed from the storage pit by a rotary plow, loaded onto a belt conveyor beneath the pit, and conveyed to a load-out bin situated over a "loop" track now under construction. With the completion of the rapid loading system and loop track, a train will then pull into the mine, traverse the loop track going under the load-out bin; and with the locomotives supplying all motive power, the coal will be loaded without having to stop the train's movement.

3.55 Preparation Facilities:

Preparation facilities at the mine do not include a washing or cleaning plant, but do include crushing facilities. There is a 300 ton truck dump hopper with a feeder located at the bottom of the hopper. (See Figure 6.) The feeder feeds coal onto an elevating "run of mine" belt conveyor that elevates the coal to the top of a structure containing the screening and crushing machinery.

The coal is discharged from the run-of-the-mine belt conveyor directly into a primary crusher. From the primary crusher, the coal passes over a double-deck vibrating screen with the minus 2-inch pieces of coal dropping to the loading chute and the plus 2-inch pieces of coal being directed into a secondary crusher. Any plus 8-inch coal from the primary crusher is scalped from the top of the vibrating screen, dropped to the ground, and hauled back to the pit for burial under the overburden at the bottom of the pit. The product of the secondary crusher falls directly into the loading chute. From the loading chute, the coal falls into railroad cars and completes the loading cycle.

This preparation facility at the present time runs only on days when there is a train to load, but with the completion of the above mentioned new stockpile and rapid load out system, the preparation plant will run about five days per week.

3.6 Water Uses

3.61 Water Use:

Since there is no washer used at this mine, the water requirements are minimal. The largest use for water is in the control of dust on the haulage roads which requires about 60,000 gallons each day the haulage trucks operate when dust control is needed. A year's operation requires about 12,000,000 gallons of water.

The other use of water is in the office, garage and bathhouse, and on an annual basis requires about 3,000,000 gallons.

There will be no significant increased requirements for these uses.

3.62 Water Sources:

Water used for dust suppression on the haulage roads is presently obtained from water collected in an inactive pit. This water is primarily surface runoff water supplemented by a small amount of ground seep water.

Water for use in the office, garage and bathhouse is obtained from two shallow, drilled wells which produce only about 25 gallons per minute.

3.7 Alternative Mining Methods Considered

3.71 Overburden Removal:

For the removal of overburden, careful consideration was

given to the type of machine which best suits the conditions at this mine. Initial studies proved that a shovel operation would not lend itself to the recovery of both the Rosebud seam and the McKay seam. The nature of the machine and the way it travels limits its adaptability to mining these two particular coal seams due to their physical relationship.

Also, because a shovel with its fixed "reach" is confined to traveling up and down a pit and on top of the coal seam being uncovered, it casts the last material dug on top. This prohibits the proper placement of spoil material for reclamation purposes.

A dragline, conversely, sits on the surface of the ground to dig, can move about and take advantage of its "reach" to place various portions of overburden in the most advantageous location for reclamation. The dragline's ability to dig from both the original surface over the top seam and then move into the spoil, if necessary, to dig the parting material, provides a much more flexible operation and better control on placement of spoil material. With these facts considered, it was decided to utilize a dragline excavator at this operation.

3.72 Type of Power:

With the selection of the type of excavator to be used, the question of how to power the machine next arose. There are two types of power available for excavators - diesel and electric. Because of the remoteness of the mine and the long distances which diesel fuel must be hauled, and the difficulty in

getting fuel to the machine during periods of adverse weather conditions, it was decided to electrify the machines so the energy source would be dependable. It was also noted that electric power would provide a quieter operation, since diesel engines big enough to power this size equipment are very noisy and can be heard for miles.

The dependability of power supply also determined the use of electricity for the loading shovel. As stated earlier, the loading operation is supplemented with a front-end loader which is diesel powered; however, loading from the coal seam is not the primary job of the front-end loader at this mine.

Big Sky Mine is currently using approximately 460,000 kilowatts of electricity, 20,000 gallons of diesel fuel and 1,200 gallons of gasoline per month in its operations. New equipment and loading facilities will increase these uses to approximately 1,380,000 kilowatts and 1,440 gallons of diesel fuel. There will be only a slight increase in gasoline use.

3.73 Types of Transportation:

The type of transportation of raw coal from the pit to the crushing plant received considerable thought before a system was selected.

Belt conveyors are an excellent means of moving large volumes of materials, but to properly utilize this method many conditions must be present. Capital investment in a conveyor system is very large and consequently it must be used for a long period to justify its purchase and installation costs. The

irregular shape of the coal field and the pitch of the original ground surface severely limits the length of time the mining operation will be located in any given "work area" of the field. Thus the length of time a conveyor system could be used in a specific area would be short and very costly. Therefore, it was determined that trucks would provide the best haulage system at this operation. There is approximately one mile of road and four trucks serving the system.

Transportation to the customer is provided by the Burlington-Northern Railroad. A seven and one-half mile spur track connects the Big Sky Mine to the tracks of the Burlington-Northern Railroad at Colstrip, Montana. From Colstrip, the coal travels about forty miles north over a spur track of the Burlington-Northern to the town of Forsyth, Montana where it connects with the main line of the Burlington-Northern. Delivery to a customer is then made over regular railroad routes.

3.8 Personnel

3.81 Supervisory:

In addition to the Superintendent and Assistant Superintendent, there are five non-union employees:

Office clerk
Warehouse clerk
Master mechanic
Second shift foreman
Safety coordinator

3.82 Construction:

There is no regular construction crew at the mine. When new facilities are built or when major modifications to existing equipment are done, the work is contracted to regular construction companies. Normal repair work and minor revisions in the equipment are done by the workers of the mine. No additional employees who become residents of the area have been moved to the area for the express purpose of doing construction work.

3.83 Production:

At the end of 1972, there were 41 United Mine Workers of America employees at the mine including:

3 - Dragline operators
1 - Swing shift operator
2 - Loading operators
6 - Truck drivers
5 - Oilers
2 - Tipple operators
3 - Laborers
5 - Bulldozer operators
1 - Front-end Loader operator
1 - Grader operator
5 - Welders
1 - Electrician
2 - Mechanics
2 - Drillers
1 - Shooter
1 - Greaseman

3.84 Maintenance:

Normal, routine maintenance on mining equipment is performed by production employees. The welders, mechanics, electrician, and one laborer, for a total of nine, normally are so classified.

3.85 Reclamation:

Reclamation at Big Sky is accomplished under the direction of Peabody Coal Company's Land Use and Reclamation Department. Supervision is under the control of the Reclamation Supervisor, Western Surface Operations, whose headquarters is at the Big Sky Mine. Actual grading work is performed by union personnel who are production employees. Seeding and planting are performed by part-time personnel at the appropriate times of the year.

3.9 Dust Control

The principal source of fugitive dust emanates from traffic on the haulage roads. Control is achieved through application of water as discussed in Section 3.52 and 3.6 with water trucks of 8,000 gallon capacity.

3.10 Noise Control

Noise control in the working areas of the mine is accomplished within the requirements of the Coal Mine Health and Safety Act and its regulations. This Act is concerned with the safety and welfare of the mine employees.

Noise as measured beyond the property line and as it affects persons not related to the mine is discussed in Section 5.4.

See Section 3.2
Map--page 19

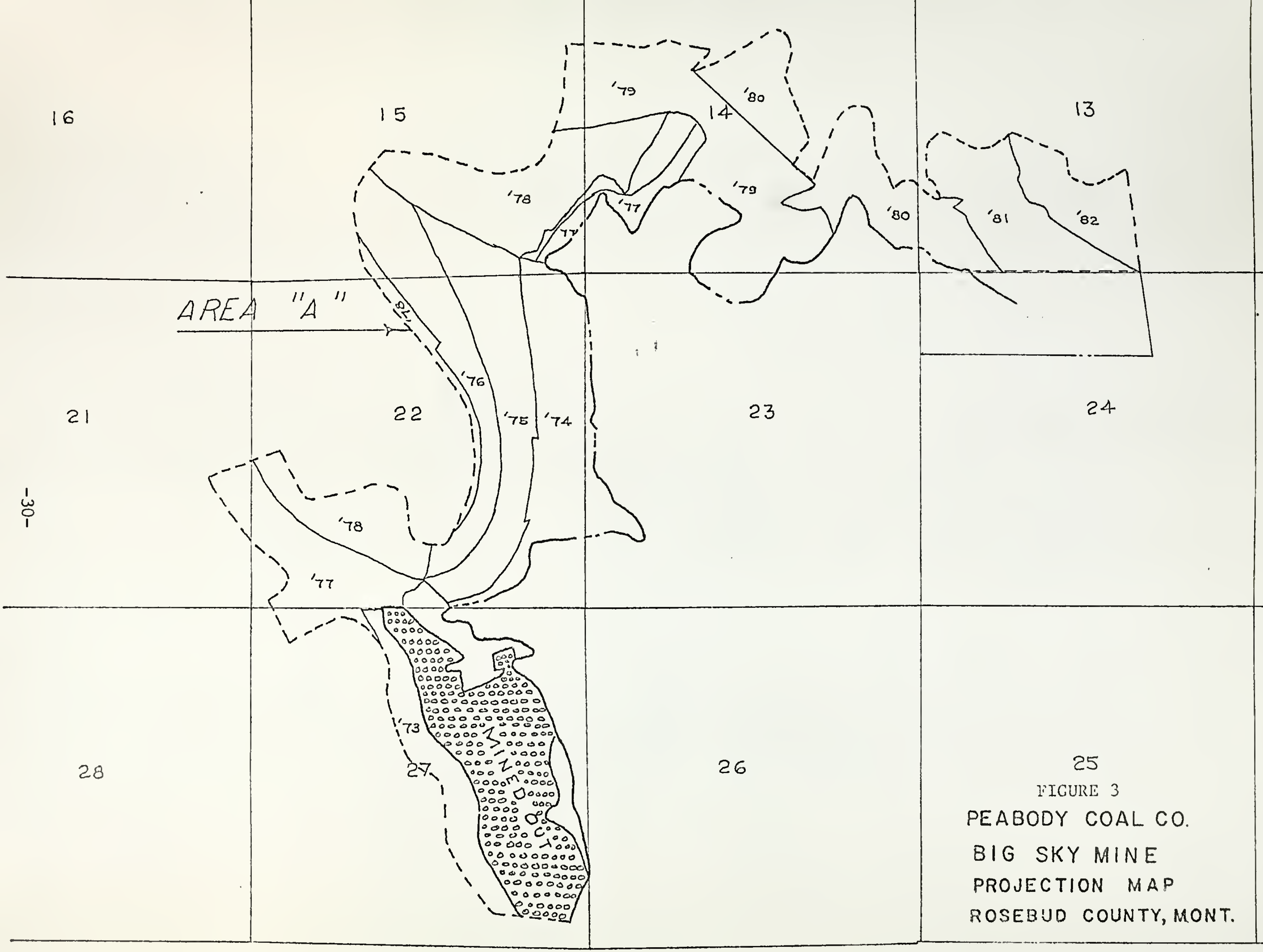


FIGURE 3
PEABODY COAL CO.
BIG SKY MINE
PROJECTION MAP
ROSEBUD COUNTY, MONT.

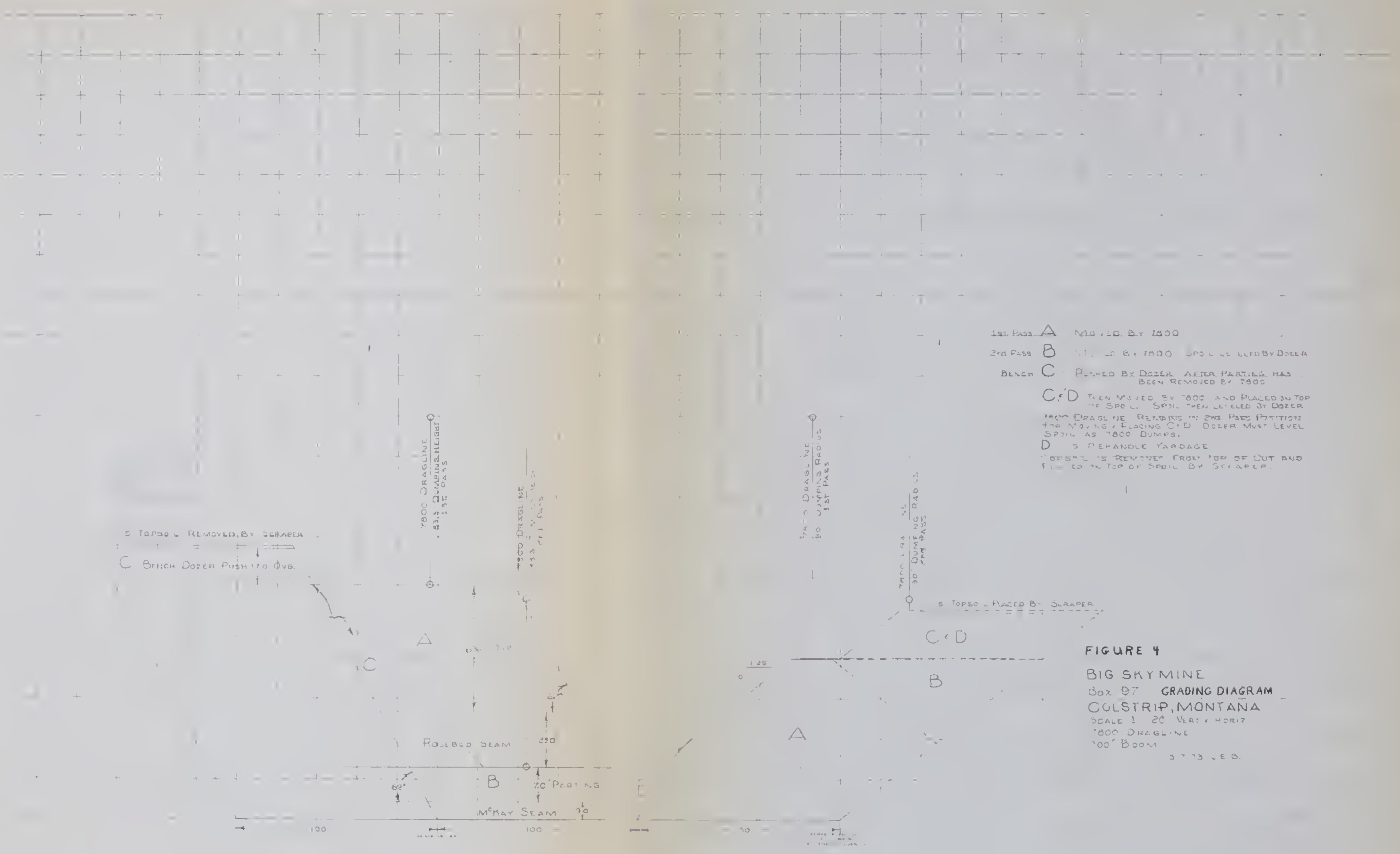

1st Pass A Moved By 7800
2nd Pass B Moved By 7800 Spoil Leveled By Dozer
Bench C - Pushed By Dozer After Parting Has Been Removed By 7800
C & D Then Moved By 7800 and Placed on Top of Spoil. Spoil Then Leveled By Dozer
7800 Dragline Remains in 2nd Pass Position for Moving & Placing C & D Dozer Must Level Spoil as 7800 Dumps.
D Is Rehandle Yardage
Topsoil Is Removed From Top of Cut and Placed on Top of Spoil By Scraper.
5' Topsoil Removed By Scraper
C Bench Dozer Push 170' Ave.
7800 Dragline 83.3 Dumping Height 1st Pass
7800 Dragline 2nd Pass
A
C
B
Rosebud Seam
20' Parting
McKay Seam
100
100
7800 Dragline 180 Dumping Radius 1st Pass
7800 Dragline 190 Dumping Radius 2nd Pass
5' Topsoil Placed By Scraper
C & D
1.25
B
A

FIGURE 4

BIG SKY MINE
Box 97 **GRADING DIAGRAM**
COLSTRIP, MONTANA
SCALE 1 20 VERT & HORIZ
7800 DRAGLINE
300' BOOM
5 7 73 L E B.

See Section 3.4
Typical Pit and Spoils--page 20

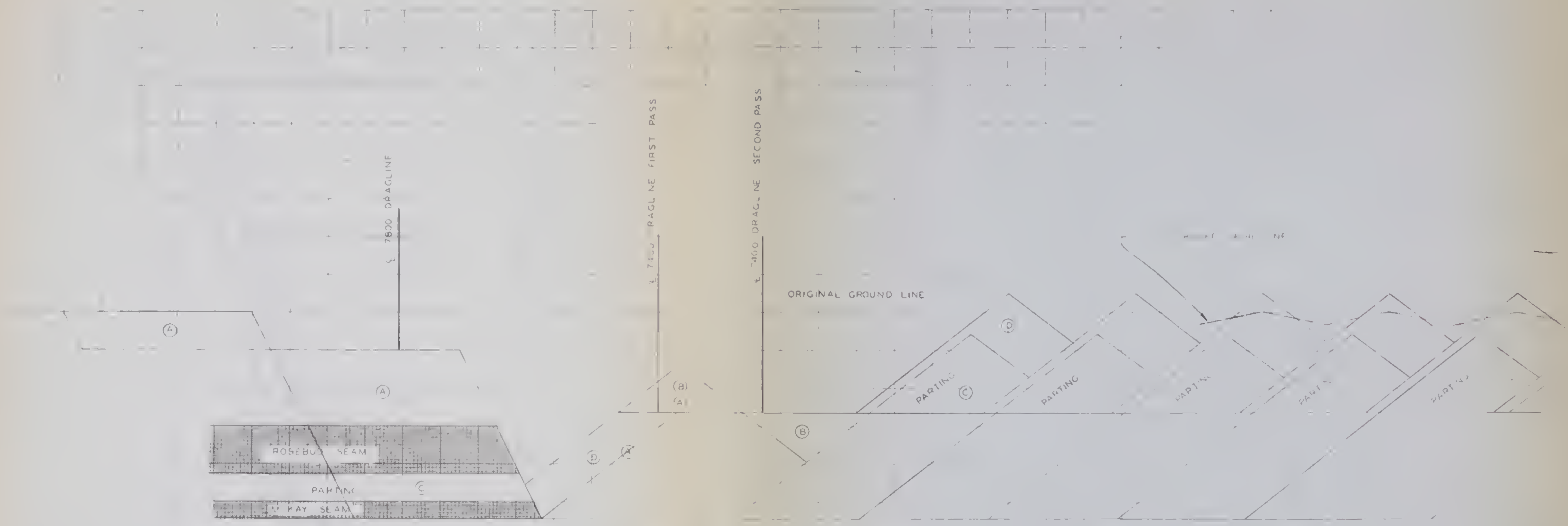


FIGURE 5

BIG SKY MINE

GRADING DIAGRAM

8 0 DRAGLINE W 400 DRAGLINE AS PULL BACK

SCALE 1"=20'

REHANDLE 35% INCLUDES BENCH FR PA A

T JUNE 5 973

See Section 3.53
Storage Facilities--page 21

FIGURE 6
PRESENT LOADING FACILITIES

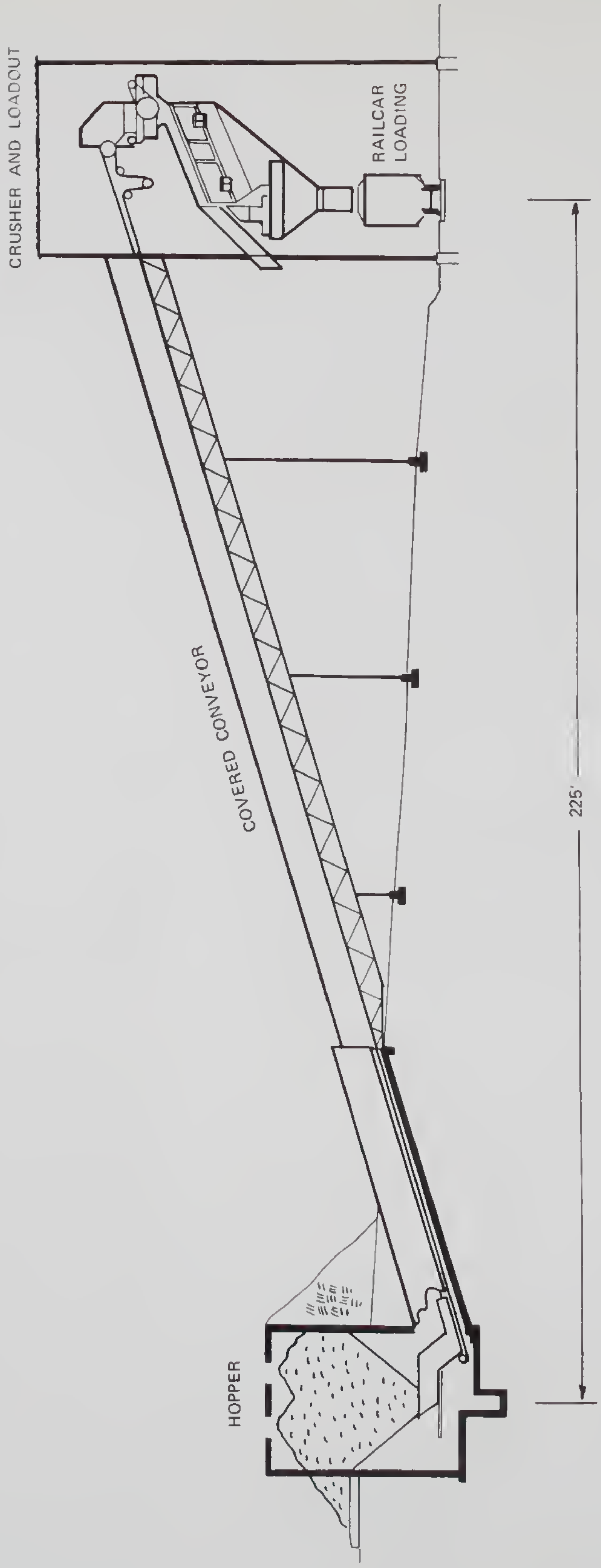
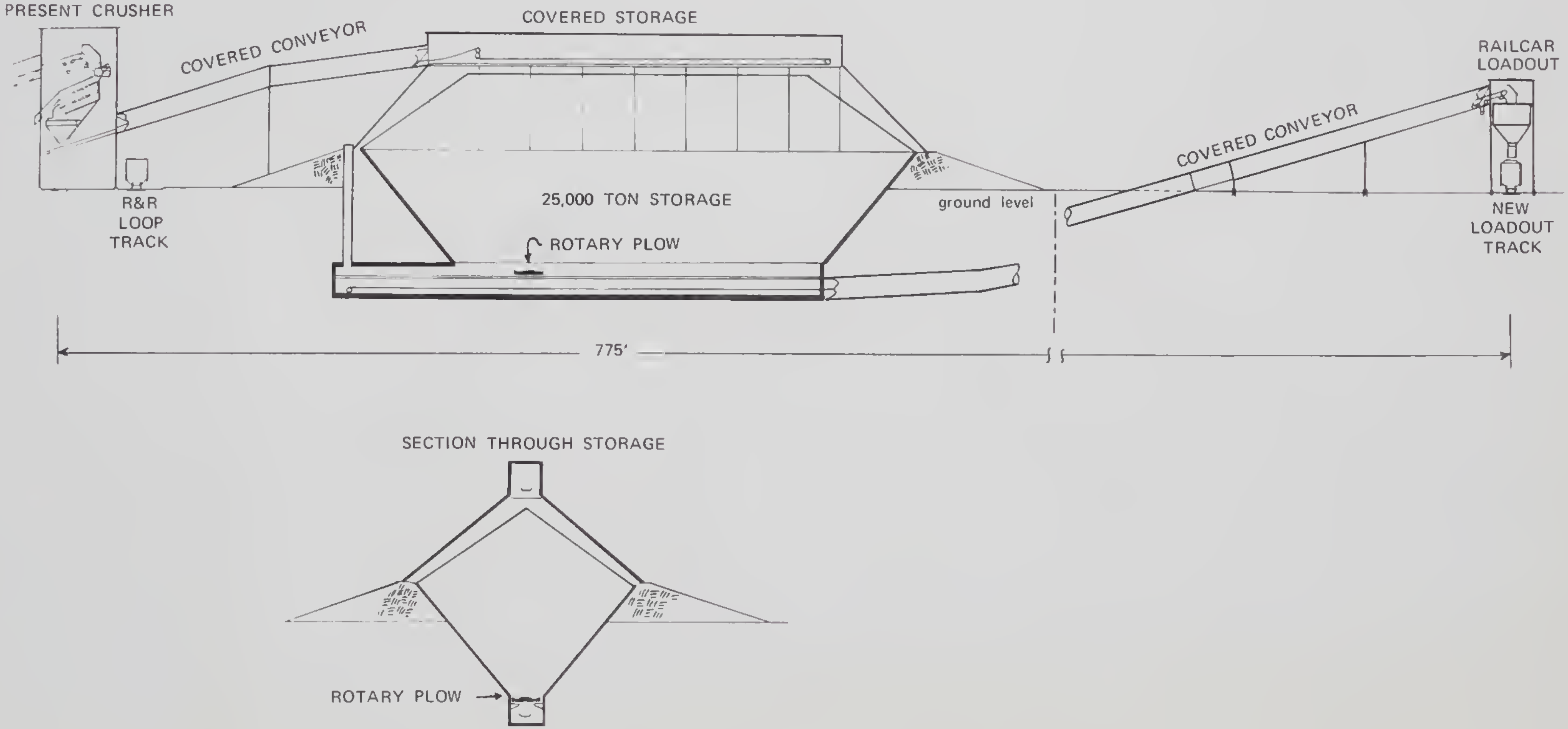
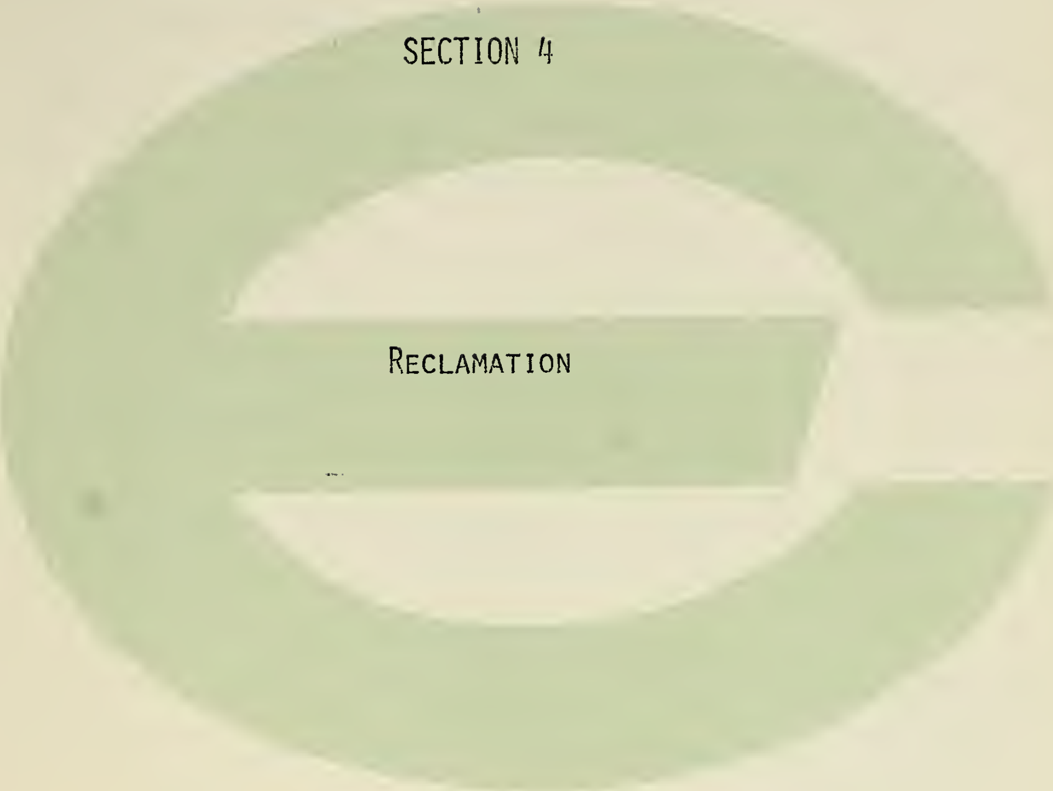


FIGURE 7

NEW FACILITIES



See Section 3.53
Storage Facilities--page 21



SECTION 4

RECLAMATION

4. RECLAMATION

4.1 Purpose of Reclamation

The major part of this area was used for range pasture prior to mining and Peabody Coal Company reclamation plans are directed toward returning it to this use. Other values of the area, such as wildlife and recreation, are also recognized.

Mining and reclamation must be a system of coordinated processes and integrated operations going on simultaneously. At any given time during the life of the mine, there will be reclaimed areas, areas in the process of being reclaimed, and actively mined areas.

Peabody Coal Company's goal is to return the area to a productive use with an aesthetically pleasing appearance in accordance with state law and regulations.

4.2 Grading and Highwall Reduction

4.21 Method of Removal and Fill:

Reclamation equipment will not be removed from the general area of operation until backfilling and grading are completed on the disturbed area. In this rather typical open cut mine, topsoil will be removed from the undisturbed ground prior to placement of the overburden from the box cut. Upon completion of the box cut, overburden from each successive pit will be placed in a prior pit, a process known as backfilling, after removing the marketable coal.

4.22 Grading:

Grading shall be kept as current as possible as mining progresses. Only two backfilled ridges of overburden will be ungraded at anytime during the mining process with the exception of the box cut.

4.23 Final Grading and Topography:

Final grading will be done with no slopes steeper than (5:1) with the exception of the highwalls and railroads as required by the state's regulations. The grading will produce a very gently rolling topography similar to the original terrain, except that it will not contain the numerous sharply cut banks and steeply sloped clinker nobs common to the area. The elevation of the graded areas will be similar to the original, due to the swelling effect produced by the handling of the overburden. Swelling occurs because of the loosening of the original soil compaction which was produced over millions of years. When the overburden is relaced in the pits, the loosened material contains voids and air spaces which generally create a swell of 22-25%.

4.24 Erosion Control:

On the gentle (5.1) slopes covered by topsoil, erosion problems can be controlled with a quick vegetative cover. Terraces are being installed on exceptionally long slopes under the current reclamation program and could easily be installed on others if needed. By nature, any terrace on a (5:1) slope will have a greater than (5:1) slope on its downslope side.

Terraces are currently produced either during the grading of the overburden or with the application of additional topsoil in bands following the contour. Terrace intervals will, by necessity, vary depending upon slope exposure, length, steepness, and composition of the materials involved. These terrace intervals will need to be determined by on-site inspection and experimentation.

4.25 Highwall Reduction:

Highwalls will be reduced, with the steepest slope of the reduced highwall being no greater than twenty degrees from the horizontal. Highwall reduction will be commenced at or beyond the top of the highwall and sloped to the graded spoil bank. The final pits will be backfilled so as to cover all exposed coal seams with four feet of fill material.

The final highwall will be drilled and shot with ammonium nitrate to no greater than twenty degrees from the horizontal. Final grading will be done by dozers and the slope will tail out into the graded spoil covering all exposed coal seams in accordance with state regulations.

4.3 Roads and Railroad Loops

4.31 Location of Roads:

Haulage roads through any permitted area will be located so that their presence and use will not interfere with the grading of adjacent spoils as required by state regulations. To accomplish this, they will be constructed down dip from the crop

line of the recoverable coal seam and far enough away from the crop line to allow the placement of the box cut spoil.

4.32 Road Construction and Water Protection:

Standard road construction guidelines will be followed as set forth in the state's regulations and will include, but not limited to ditches on both sides of a through cut, the inside shoulder of a cut fill section, and proper sizing and installation of necessary drainage structures. Drainage structures will be constructed in order to cross a stream channel and will not affect the flow or sediment load of the stream.

4.33 Seeding of Cuts and Slopes:

All cuts and/or slopes caused by the construction of roads, railroads, etc. will be seeded at the first available planting time or season.

4.34 Reclamation of Transportation Routes:

Upon abandonment of any road or railroad location, the surface material and/or ballast material will be removed and disposed of or reused, if possible. The grade and subgrade material will be conditioned to receive seeding or planting, whichever is determined best for the particular area. If the subgrade material is not suitable for revegetation, it will be picked up and disposed of in a suitable location and the road bed area graded, shaped, topsoil applied and seeded or planted at the first appropriate season.

Culverts and drainage structures which were necessary during

the use of the road will be left if it is determined that their removal would cause sedimentation problems or they are necessary for continued adequate drainage. Otherwise, the structures will be removed and the drainage systems returned to their original condition.

Should a landowner desire any road left for permanent use, the landowner may request the department to waive the reclamation of the road and allow it to be left in a usable conditon.

4.4 Topsoiling

4.41 Equipment:

All available topsoil is being removed from the area to be disturbed by a 30 yard paddle wheel scraper, stockpiled, and applied to the graded areas by the same equipment, in accordance with state regulations. Whenever possible, the topsoil will be removed and immediately replaced on a graded surface without the delay of stockpiling. Peabody Coal Company has and will continue to disc topsoiled areas prior to seeding.

4.42 Stockpiles:

Stockpiles of salvaged topsoil are located in areas where they will not be disturbed until needed. These stockpiles will be seeded with annual grasses at the appropriate seeding season.

4.43 Soil Amendments:

Soil tests show soil amendments have been unnecessary in

most cases; however, amendments will be added where research and plant growth indicate and if desired by the state.

Several soil scientists have suggested materials such as cattle manure, Leonardite, and other organic type materials. Peabody Coal Company favors research projects which properly document soil problems and results and will implement resulting suggestions if approved by the state.

4.5 Planting and Revegetation

4.51 Principle Legume Species:

The major part of this area has been used for range pasture and Peabody Coal Company plans to return most of the land to rangeland. The company's reclamation experience has shown that alfalfa is one of the species well adapted to surface mined lands and it is considered a good forage for both domestic stock and wildlife species. Soil tests indicate that, except for nitrogen, the essential plant nutrients for alfalfa growth are present. Therefore, this along with sweet clover, will be one of the principle legume species used in reclamation.

4.52 Other Species Used:

Experimental trails with other legumes include cicer milkvetch *(Astragalus cicer)*, sainfoin *(Onobruchis viciaefolia)*, and birdsfoot trefoil *(Lotus comiculatus)*, wild licorice *(Glycyrrhiza lepidota)*, black medic *(Medicago lupulina)*, and

white prairie-clover *(Petalostemon candidum)*. Grass species used will include western wheatgrass *(Agropyron smithii)*, crested wheatgrass *(Agropyron desertorum)*, smooth brome *(Bromus inermis)*, green needlegrass *(Stipa viridula)*, and Indian ricegrass *(Oryzopsis hymenoides)*. Soap-weed *(Yucca glauca)* will also be used.

The mixture used in 1973 included: Legumes--Alfalfa, 5 lbs., White Sweet Clover, 2½ lbs., Yellow Sweet Clover, 2½ lbs. and Ciscer Milk Vetch, 1 lb.; Grasses--Crested Wheatgrass, 2½ lbs., Western Wheatgrass, 3 lbs., Smooth Brome, 3 lbs., Russian Wild Rye, 2 lbs., Green Needlegrass, 2 lbs., and Intermediate Wheatgrass, 3 lbs.; Annual grasses (used as a nurse crop)--Oats, 30 lbs., Wheat, 40 lbs., Sorghum, 10-15 lbs., and Millet, 10-15 lbs. Peabody Coal Company will continue using a similar mixture or such mixtures approved by the state.

4.53 Tree and Shrub Species Used:

Tree species presently being used in the revegetation program include ponderosa pine *(Pinus ponderosa)*, willow *(Salix spp.)*, and green ash *(Fraxinus pennsylvanica)*. Shrubs used in the revegetation program in the last three years include buffaloberry *(Shepherdia argentea)*, chokecherry *(Prunus virginiana)*, Caragana *(Caragana aborescens)*, and skunkbush sumac *Rhus trilobata)*. See Section 1.6 for results of reclamation success to date.

4.54 Time of Seeding:

Seedings will be made in the first proper season following grading and topsoil. Annual grasses as listed above will be

used as a nurse crop. When weather permits, replaced topsoil will be seeded within 90 days.

4.55 Methods of Seeding:

Peabody Coal Company's method of seeding has been to disc, distribute with an Ezee flow seeder and cover with a harrow. This has been done in one operation with good distribution and seed cover resulting. Other methods will be used if deemed proper and necessary.

4.56 Sources of Seeds:

Whenever possible, locally grown genotypical seed will be purchased. Some native species are not produced in sufficient quantity or quality in Montana and, therefore, must be purchased from nearby states.

4.57 Rate of Seeding:

Seed of 90% purity will be purchased whenever possible. Often, germination is variable and the rate of seeding will be calculated on the germination percentage, Not less than 20 pounds of seed per acre will be distributed and as much as 30 pounds per acre will be used with broadcast seeding.

4.58 Site Factors:

The trees and shrubs used in the revegetation program are being planted relevant to site factors, such as moisture, soil, slope, etc.

4.59 Irrigation of Initial Seeding:

Irrigation has been used to get a quick start on the initial seeding; however, it will not be used after the first year. The water is pumped from the pit--an essential operation in mining--rather than "waste" the water.

4.6 Soil

4.61 Results of Soil Tests:

The attached reports (Appendices 2, 3, and 4) present overburden analysis and soil survey of the area. A detailed soil survey is also being conducted, as well as continuing investigation about reclamation possibilities with various soil types and combination of soil types found in the area. As information is gathered and analyzed, it will be incorporated into reclamation plans.

Extensive coring and analysis indicate there are no toxic materials (either sulfurous or alkaline) associated with the overburden in this area. A diagram for placement methods involving overburden material has been prepared (see Figure 4 and 5).

4.62 Recommendations by Soil Scientists:

The following are recommendations from a soil survey by John L. Parker. (Appendix 2)

The Lambeth Series shows that "the depth of removal for stripping ranges from 18 to 20 inches." Peabody Coal Company will do everything possible to comply with this suggestion.

The Ringling Series indicate that "removal layer for stripping between 4-5 inches." This amount may be difficult to pick up with the scraper; however, Peabody Coal Company will endeavor to salvage this amount from this Series.

The Tullock Series shows that "removal of topsoil can be between 16-20 inches." Again, Peabody Coal Company will comply with this suggestion.

The Yawdin Series indicates that "removal layer for stripping topsoil is between 10-12 inches." Peabody Coal Company will comply with this directive.

4.7 Reclamation Equipment

Reclamation equipment at the Big Sky Mine includes: A caterpillar D-8 and D-9 for grading and backfilling, a Wabco 30 cubic yard paddle scraper for picking up and replacing topsoil, and an Ezee flow seeder and harrow for seeding. Hand seeding and planting are done where necessary.

4.8 Waste Disposal

There are no plans for the placement of fly ash in the mine. The only foreign materials anticipated to be buried in the pits are those common to this type of mining, i.e. lumber, scrap metal, tipple rejects, etc.

SECTION 5

Present Environment

5. PRESENT ENVIRONMENT

5.1 Climatology

This area has a continental climate with abundant sun, low relative humidity, light precipitation, moderate southwesterly winds, and large diurnal temperature differences. The climate of the area is quite variable with a temperature range of as much as 140° in many years, sometimes ranging from -40°F. to 100°F. July is generally the hottest month and December, the coldest. Mean annual precipitation for the area is 14.9 inches, with snow melt contributing approximately 4.5 inches to the annual total. Rains usually begin in March and peak in May or June. Summers are generally hot and relatively dry. Thunderstorms and moderate winds are common during the summer months. The average frost-free period is 125 days, with the date of the last spring freeze between May 15 and 25, and the first fall freeze between September 15 and 22. Winds occurring during winter storms are usually northerly or northeasterly and may reach velocities in excess of 30 miles per hour.

5.2 Hydrology

5.21 Surface Water:

Miller Coulee is definitely an intermittent stream, as defined by Montana State water quality standards. Area A is confined to the Miller Coulee drainage.

5.22 Groundwater:

In 1970 Peabody Coal Company initiated a hydrology study with the Montana Agricultural Experiment Station. (See Appendix No. 5.)

A series of seventeen test holes were drilled by Peabody Coal Company to depths ranging from 38 feet to 160 feet. These test holes are generally located to the west, north and northeast of the area to be mined. These holes were drilled primarily to determine the nature of near-surface stratigraphy and local depth to the aquifer(s) which could be affected by the mining operations. In addition, a series of eight wells were drilled in the immediate vicinity of the mine, primarily to the west and east, for the purpose of monitoring any changes in groundwater quality or quantity which might result from the mining operations.

Based on the data obtained, the near-surface stratigraphy consists of a surficial deposit of unconsolidated sand or topsoil overlying interbedded units of sandstone, shale and coal. In five of the seventeen holes, water was encountered in association with a coal seam, in three it was found in conjunction with a sandstone unit; in at least three of the test holes there is a suggestion that the water bearing stratum or sandy shale and six of the holes did not penetrate an aquifer.

A series of stratigraphic cross-sections suggest there is no uniform formational dip in the immediate vicinity of the mine area and that the individual sandstone, shale and coal units are spatially discontinuous, grading laterally from one type to another. If true, this undoubtedly reflects local variations and differences which existed in the depositional environment. The regional dip of the strata is generally east or east-northeast, according to personal communication with Richard L. Hodder, Montana Agricultural Experiment Station, Bozeman, Montana. The cross-section described

above indicate this regional dip varies locally and, in places, is reversed. There is, therefore, no single down-dip direction in the immediate vicinity of the mining operation, and based on stratigraphic and structural criteria, there is no way to specify either the source or the ultimate destination of the water contained in the near-surface aquifers. Because of the apparent facies relationship which exists among the sandstone, shale and coal units, there is no uniform thickness of the water bearing strata.

There are presently no quantitative data relating to either the quantity of groundwater present in the area or the transmissibility of the aquifer system. In terms of transmissibility, a limited number of subjective evaluations are available (Richard Hodder, personal communication) which suggest that this parameter may have a low value in the study area. Water inflow from the aquifers into the mine pit is normally extremely slow and the level of water in wells adjacent to the mining operations shows no significant fluctuations until blasting and mining activities reach to within approximately 100 feet of the well.

From the available data, it appears the near-surface aquifers which will be affected by the mining operations at the Big Sky Mine are not a primary regional water source. In addition, based upon more general hydrogeological considerations, it can be assumed that the mine itself will act primarily as a local perturbation on these near-surface aquifers, analogous to the cone of depression which will result from any extraction of water from these aquifers. Because of the presumed low transmissibility of the rock units in which the water is found, the spatial impact on

the regional water table should be minimal. Because of the dynamic aspects of groundwater as a resource, an on-going monitoring program will be established to ascertain the impact of the mining activities on the groundwater reserves of the area. Additional work would be required before it will be possible to link any spatial or temporal changes in these reserves to a specific cause.

5.23 Sources:

No springs have been discovered within a radius of several miles of the mining area (Richard Hodder, personal communication). There are approximately 35 existing wells in the immediate vicinity of the mine; however, there are no production data available for these wells at the present time. A map showing the location of these wells has been submitted to the state with the Permit Application as Exhibit G.

5.24 Town Supply:

The town of Colstrip, Montana, is presently obtaining its water supplies from wells drilled to a depth of approximately 400 feet (Richard Hodder, personal communication). Because of the relative elevation of the mine area and the town of Colstrip (ca. 3240 ft. a.s.l. va. 3225 ft. a.s.l.) and the lack of a readily detectable regional dip in the local geologic formations, it may be assumed that the source of Colstrip's water supplies will not be affected by the Peabody Coal Company mining activities. It may also be assumed there are one or more aquifers in the area which are at a depth greater than that which will be reached by

the mining activities and which constitute alternative sources of water for domestic and municipal uses in the area.

5.25 Continued Study:

A study is currently in progress to determine the effect of mining on the water table, and results will be made available to the state upon its completion.

5.3 Air Quality

Ambient air quality should not be measureably degraded with mining operations and burning of coal is not done. All potential dust emission problems from operations will be alleviated as explained in Section 6.1. Studies are planned to provide ambient air quality and meteorological data (see Sections 6.13 and 6.15) to verify the expected minimal impact.

5.4 Noise

A noise survey conducted July 25, 1973, at Big Sky Mine, shows that the noise generated from the present mining operations does not affect outlying populated areas and is seldom great enough to be of nuisance value even at the mine property boundaries.

5.5 Biological Conditions

5.51 Vegetation:

An analytical assessment of the vegetation conditions of the Peabody Big Sky Mine Area A was initiated in early July 1973. The results of these studies are reported in Appendix 6.

Area A of the Big Sky Mine lies within the Eastern Ponderosa Pine Forest formation as described by Küchler (1964). Seven native vegetation types and three agricultural vegetation types were recognized. The percentage of the study area occupied by each vegetation type is as follows: Big Sagebrush-Grassland, 7%; Silver Sagebrush-Grassland, 30.7%, *Rhus*-Grassland, 19.2%; Ponderosa Pine, 16.4%; Ponderosa Pine-Juniper, 13.1%, Caprock-Gumbo Knob, .1%; Creek Bottom, 4.3%; and the agricultural vegetation types, 24% of the area. Each type was quantitatively measured and the results appear in the Appendix. Vegetation studies are continuing at this time.

5.52 Wildlife Conditions:

A systematic survey of the faunal conditions of the Peabody Big Sky Coal Mine Area A was begun in early July, 1973. The results of these studies are reported in Appendix 7.

Observation routes and trap lines were established to confirm the presence and relative abundance of the terrestial animal species. A detailed account of the procedures conducted and the resulting findings appears in the Appendix. No recognized rare or endangered species were encountered on the area. These studies are continuing and an evaluation of the aquatic fauna and habitats is planned for the near future.

5.6 Land Use

5.61 Agriculture:

Agriculture is one of the most important economic activities

occurring in Area A. Approximately 24% of the area is utilized for crop production. Wheat and alfalfa are the major crop varieties grown.

5.62 Grazing:

Livestock production is the largest economic activity of the area, amounting to about 75% of Area A. Natural or native grassland accounts for almost all of the grazing land.

5.63 Wildlife:

Major game species are mule deer and sharp-tailed grouse. See Appendix 7 for a more complete evaluation of wildlife fauna occurring in Area A.

5.64 Forestry:

There is no commercial timber occurring in Area A, although some amount of Ponderosa pine furnishes cover for deer, sharp-tailed grouse, and other wildlife species.

5.65 Roads and Railroads:

There are no county or state roads in Area A. A company-maintained access road runs from State Highway 315 to the mine site. The only other roads are primitive trails used for access to the area by residents. The only railroad is a spur of the Burlington-Northern Company used to haul coal from the mine tipple, and joins the main Burlington-Northern line some 30 miles to the north.

5.66 Residential:

There are no residents in Area A, although a small house trailer court for six employees is located just east of Area A about 1½ miles from the mine office.

5.67 Industrial:

The only industrial activity in the area is that of the present Big Sky Mine.

5.68 Recreation:

Area A offers some opportunity for hiking, picnicking, and hunting in season. However, the amount of these activities is limited due to the small size of the area.

5.69 Ownership:

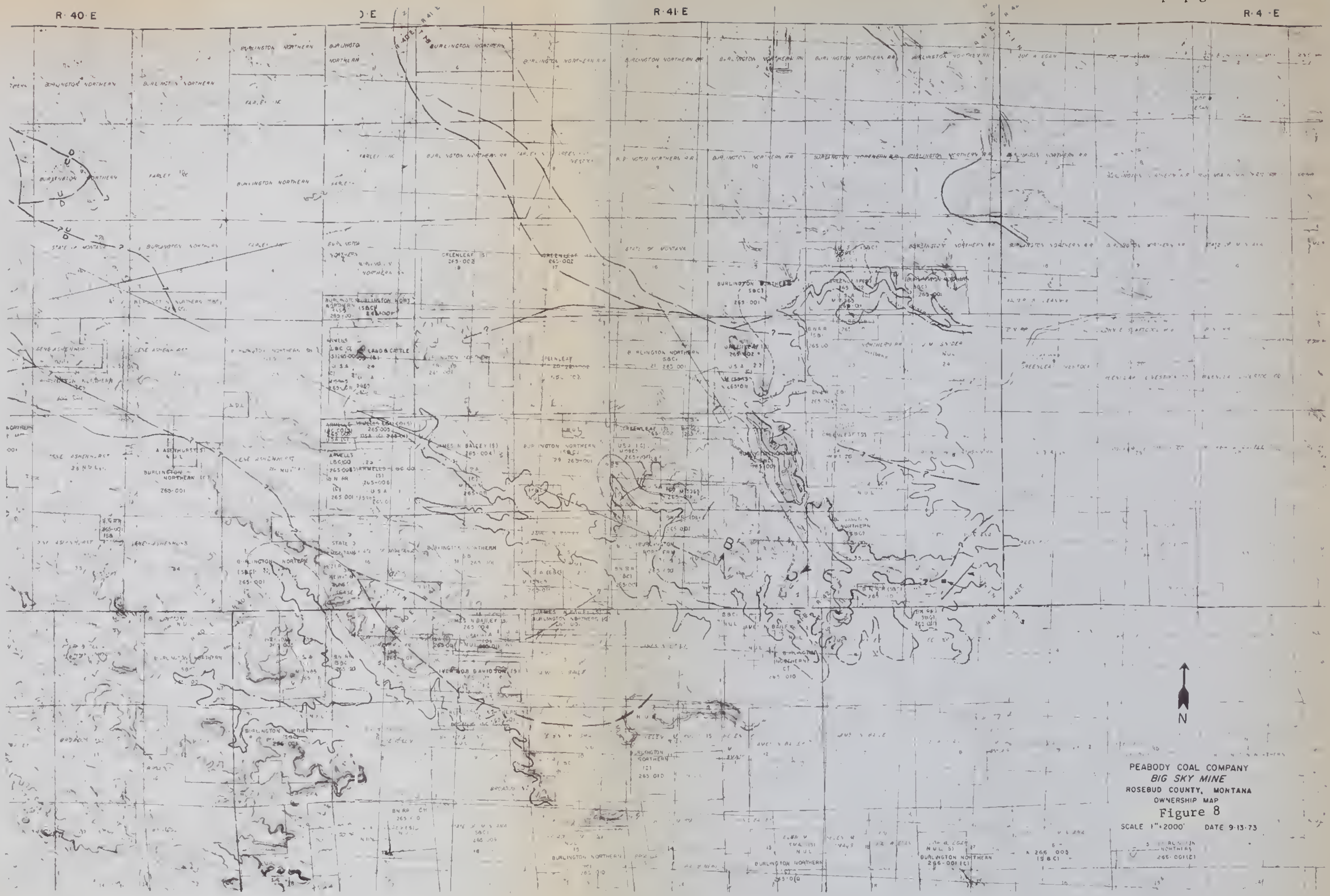
Ownership of the land surface is depicted in Figure 8.

5.7 Archaeology

In May, 1971, agents of Peabody Coal Company contracted with the University of Montana Statewide Archaeological Survey, through the University of Montana Foundation to conduct an archaeological survey in Rosebud County. In July, a seven-man crew began work in the area and subsequently recorded 17 archaeological sites. (See Appendix 8.) These sites were divided into six types: Lookout stations or observation posts, open habitation sites, rock art panels, quarries, bison kills, and rock shelters.

Of these sites, eight evidenced substantial cultural material on the surface or possessed other qualities that warranted their being

See Section 5.69
Ownership--page 52



PEABODY COAL COMPANY
BIG SKY MINE
ROSEBUD COUNTY, MONTANA
OWNERSHIP MAP
Figure 8
SCALE 1"=2000' DATE 9·13·73

tested for subsurface deposits. Test trenches indicated that four of these sites contained significant amounts of prehistoric cultural remains. Upon being appraised of this information, Peabody Coal Company agreed to a second contract which provided funds for archaeological salvage excavations at those sites.

5.8 Aesthetics

Concerning aesthetics, the overall beauty of the area will be marred by the spoil banks and mining activities during the period of mining. The mine complex is large enough in size that it can be observed from a considerable distance. However, the mine site location is largely surrounded by ridges rising 200-300 feet above the level of the mine which limit the visability of the mine. The spoil banks and tipple of the mine can be seen from Highway 315 approximately 2½ miles east of the mine and, of course, from the air. Once away from the immediate mine area, the natural beauty is undisturbed and is intermingled with pastoral scenes of agricultural activity. When grading and reclamation are accomplished, the area should again have an aesthetically pleasing appearance.

5.9 Human Resources and Economic Impact

The following information was prepared by: Richard R. Howes of the Center for Economics and Planning, 216 E. Koch Street, Bozeman, Montana, September, 1973.

5.91 Population:

The population of Montana in 1970 was 694,409. The mine is located in the Billings Bureau of Economic Analysis Economic Area,

Area No. 95, which has a population of 247,000. The Billings area ranked 158th out of 173 BEA Economic Areas in population.

The Billings Economic Area is used for projections because it is the smallest area for which published projections are available. Even though the area is large in geographical terms, the amount of economic activity is limited. Projections based on smaller geographic units would be of dubious value even if they were available in published form. The Billings Economic Area is comprised of 19 counties in southern and eastern Montana and five counties in northwestern Wyoming.

The population characteristics of Rosebud and Bighorn Counties are shown in Table 1. Indians comprise 30% of the population of Rosebud County and 39% of Bighorn County. While the state population increased 2.9% between 1960 and 1970, Rosebud declined 2.5% and Bighorn grew only .5% despite their having the two highest fertility ratios in the state.

A substantial number of county residents are in-migrants to Montana, 38% in Rosebud and 32% in Bighorn County, according to the 1970 Census. The percent of in-migrants at the state level for whites was 41.2%, while for all other races it was 20.2%. It could be inferred that the white population of the area is quite mobile with substantial in and out migration, while the Indian population is not as mobile.

An estimate of the total population change could be derived from the estimate of change in total employment and an estimate of the average number of persons per family for new employees.

TABLE 1

(See Section 5.91)

POPULATION CHARACTERISTICS OF ROSEBUD AND BIGHORN COUNTIES

(Source 1970 Census)

Classification	Rosebud	Bighorn
Total	6,032	10,057
Percent Change from 1960	-2.5	.5
White	4,203	6,018
Male	2,164	3,032
Female	2,039	2,986
Indian	1,820	3,917
Male	884	1,900
Female	936	2,017
Other	9	64
Percent Under 18	39.6	42.1
Between 18 and 64	50.2	51.0
Over 64	10.2	6.9
Born in Montana	3,759	6,804
Percent of Total	62.32	67.65
Fertility Ratio[1]	473	485
Families with incomes less than the poverty level	301	474
Percent of All Families	20	21.4
Unrelated Individuals with incomes less than poverty level	176	189
Percent of All Unrelated Individuals	35.2	33.3

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[1] Children under 5 per 1000 females between 15 and 49 (PC(1)-B28 Mont. p.31)

However, sufficient data were not available to estimate the average number of persons per family for new employees. Therefore, an estimate of total population change was not made.

5.92 Employment and Occupations:

The Big Sky Mine is located in the Billings Economic Area as defined by the U. S. Department of Commerce's Bureau of Economic Analysis. Over the past 20 years, growth in this region has been slower than the national average. Agriculture formed three-fourths of the export base of the area in 1950, but only two-fifths of the export base in 1968. As agriculture's importance in the export base declined, the importance of the petroleum and government sectors expanded. Without coal development, the Billings Economic Area is projected to continue its slow growth relative to the rest of the nation.

Rosebud County, where the mine is located, is primarily agricultural. In 1970, 511 persons were engaged in farming, forestry, or fishing in Rosebud County, while mining employed 63 persons. Table 2 presents the employment pattern by industry for Rosebud County in 1970 and Table 3 presents the employment characteristics for Rosebud, Bighorn and Yellowstone Counties. The ratio of secondary and tertiary employment to primary employment is 1.226 in Rosebud County.

Primary employment is that which is generated by industries whose products are produced primarily in response to demands rising outside of the region in question. Secondary and tertiary employment is employment in industries whose products or services

are produced in response to demands rising primarily within the region.

However, preliminary research indicates that a county with the general characteristics of Rosebud County with a fully-developed mining industry would have an expected ratio of secondary and tertiary jobs to primary jobs of 1.48; that is, for every job created in the export or basic industries, there would also be 1.48 jobs in secondary and tertiary industries. Using the observed ratio of 1.226 as a lower bound and 1.48 as an upper bound, we can calculate the expected impact on the total employment of various levels of mine operation.

It must be emphasized that the estimates of changes in secondary employment are rough approximations. There are resources in the area which are under-utilized at present. These resources, both human and physical, would absorb some of the increase in demand without an increase in employment. If this were the case, the projections of secondary and tertiary employment presented here would be overestimates.

Since the Big Sky Mine currently employs 48 workers, we would expect, using the above ratios, that there are between 98 and 119 jobs dependent upon the mine's operation. If the Peabody Coal Company is allowed to mine the federal leases they hold, they estimate that their employment will be expanded by 10 to 15 persons with an additional secondary impact of between 15 and 23 new jobs. If permission to mine federal lands is refused, then the company could continue operations at the present level for 1.5 more years before running out of coal. If they are refused a state mining permit, operations would immediately cease with the loss of 48

TABLE 2
(See Section 5.92)

EMPLOYMENT PATTERNS BY INDUSTRY FOR ROSEBUD COUNTY IN 1970
(Source 1970 Census

Total employed	2,238
*Agriculture, forestry, fisheries	511
*Mining	63
*Construction	117
*Manufacturing	174
*Railroads	101
*Other transportation	6
*Communications	9
Utilities and sanitary services	35
Wholesale trade	6
Food, bakery and dairy stores	54
Eating and drinking	100
General merchandise retailing	10
Motor vehicle retailing and service stations	67
Other retail trade	78
Banking and credit agencies	18
Insurance, real estate and other finance	35
Business and repair services	6
Private households	13
Other personal services	62
Entertainment and recreational services	17
Hospitals	70
Health services except hospitals	40
Elementary, secondary schools and colleges (government)	189
Elementary, secondary schools and colleges (private)	51
Other education and kindred services	18
Welfare, religious and non-profit organizations	209
Public administration	179

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*Primary industries

TABLE 3
(See Section 5.92)

EMPLOYMENT CHARACTERISTICS
(Source 1970 Census)

	Rosebud	Bighorn	Yellowstone
Total Civilian Labor Force	2,346	3,317	34,996
Employed	2,238	3,163	32,966
Unemployed	103	154	2,030
% Unemployed	4.6	4.6	5.8
% Working 26 weeks or less in 1969	27.9	26.56	27.11

TABLE 4
(See Section 5.92)

EMPLOYMENT PATTERN BY OCCUPATION FOR ROSEBUD COUNTY IN 1970
(Source 1970 Census)

Occupation*	No. Employed
Professional, technical and kindred	234
Physicians, dentists, etc.	16
Health workers	13
Teachers	108
Managers (except farm)	204
Sales workers	57
Clerical	304
Craftsmen, foremen and kindred	184
Operatives (except transport)	151
Transport equipment operatives	67
Laborers (except farm)	141
Farmers and farm managers	306
Farm laborers and foremen	191
Service workers	399

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*Note forestry and fisheries occupations are not included above.

primary and an estimated 58 to 70 jobs in secondary and tertiary industries.

The employment pattern by occupation for Rosebud County in 1970 is presented in Table 4. The largest occupational group is farmers, farm managers, farm laborers, and foremen, with a total of 497 persons, followed by service workers with 399.

5.93 Income Distribution:

In 1970, there were 58,200 workers in the Billings Economic Area with a mean wage of $5,224. The mean wages by industry are given in Table 5. Note that mining is the second highest paying industry, while agriculture is the lowest. Twenty-five percent of the work force earns less than $2,000 and the median wage is $4,551.

The region's share of the total U. S. income is expected to fall from .1% in 1969 to .07% in 2020, if historical trends continue. Detailed projections of earnings in the Economic Area are presented in Table 6. However, these projections were made before the current increase in coal development and do not reflect the development which is presently projected to occur.

Rosebud County families had a mean income of $7,735 and a median income of $6,717 in 1969 with 10.8% of the families earning less than $2,000. Twenty percent of all families had an income below the poverty level. This corresponds to 25.8% of all persons in the county. The "poverty level" depends upon family size, the sex of the household head, and whether the family is farm or non-farm. In 1969, the cut-off figure ranged from $1,487 for a female unrelated individual, 65 years old, living on a farm to $6,116 for

a non-farm family with a male head and with seven persons. The average threshold for a non-farm family of four headed by a male was $3,745. The total earnings and average earnings per worker by industry for Rosebud County in 1970 are shown in Table 7. While farm earnings appear to be quite high, if proprieters and their incomes are removed, the average earnings of the average farm employee fall to $3,608 per year. Note, however, that farm and ranch laborers customarily receive a portion of the wages in kind. This portion is not reported in this data. The ratio of secondary and tertiary to primary earnings calculated from total earnings data is 0.5. Crude estimates of the changes in earnings resulting from different level mine operation can now be calculated. At the present level of 48 employees with average earnings of $10,424, the total primary earnings would be $500,331 which would generate secondary earnings of $250,155 for a total of $750,496. The additional 10 to 15 jobs created by the expansion of the mine would result in primary earnings of between $104,240 and $156,360 with secondary earnings of between $52,120 and $78,180. These figures are very crude and give only an indication of the magnitude of the impact of the Big Sky Mine on the local economy.

The results above were based on average earnings in 1970. A conversation with Larry Fox, Assistant Mine Superintendent, indicated that current earnings are higher. He indicated that 40 of the mine employees earned between $11,000 and $12,000 per year, while 8 earned $15,000 to $16,000. He felt that perhaps two-thirds of the jobs created by expansion (i.e., favorable federal action) would be in the lower range while one-third would be in the upper range.

TABLE 5
(See Section 5.93)

MEAN WAGES BY INDUSTRY

(Source: Regional Analysis Information System, Bureau of Economic Analysis)

Industry	Mean Wage
Agriculture	1,343
Mining	7,343
Contract construction	8,404
Manufacturing	5,260
Transportation, communications, public utilities	6,660
Wholesale and retail trade	4,834
Finance, insurance, real estate	5,773
Services	4,738
Government	4,365

TABLE 6

(See Section 5.93)

FUTURE EARNINGS*

(Source: Regional Analysis Division, Bureau of Economic Analysis)

(In thousands of 1967 dollars)

	1980	1990	2000
Personal income	1,064,000	1,464,700	2,080,300
Total earnings	823,600	1,126,000	1,589,700
Agriculture, forestry, fisheries	92,600	104,100	122,500
Mining	30,700	37,700	47,000
Contract construction	45,100	62,200	88,200
Manufacturing	67,500	86,800	117,600
Transportation, communications, public utilities	80,900	102,600	134,400
Wholesale and retail trade	158,300	217,000	306,900
Finance, insurance, real estate	33,200	45,400	65,500
Services	134,600	198,300	297,100
Government	180,200	271,100	410,100

1967 Dollars

Per Capita Income	4,133	5,447	7,327
Per Capita Income, Relative	.87	.88	.88
Earnings Per Worker	8,664	11,342	14,906
Earnings Per Worker, Relative	.92	.93	.94

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*As noted in the text, these projections, the latest available, were made prior to recent increases in coal mining.

TABLE 7
(See Section 5.93)

TOTAL EARNINGS AND AVERAGE EARNINGS PER WORKER BY INDUSTRY FOR ROSEBUD COUNTY IN 1970

(Source: Regional Economic Information System, Bureau of Economic Analysis)

Industry	Total Earnings	Average Earnings
Farm earnings	5,676,000	8,966
Government earnings	3,809,000	8,797
Manufacturing	1,071,000	5,028
Mining*	636,000	10,095
Contract construction	304,000	10,483
Transportation, communication and public utilities	1,972,000	9,573
Wholesale and retail trade	1,251,000	5,901
Finance, insurance and real estate*	151,000	7,190
Services	2,432,000	6,400

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*Estimated earnings, actual earnings were deleted from source documents.

The high level of earnings in the mining industry creates an interesting paradox. While total county earnings are increasing, the income distribution may actually become worse, if people move into the county to take the high paying jobs in mining, or if the poor do not move up into higher paying positions. This could be an especially acute problem with the large Indian population. Mr. Fox said that Peabody Coal Company does not have a formal on-the-job training program at the Big Sky Mine, but he said that the company policy is to attempt to employ minorities in the same ratio that they occur in the population. However, the mine currently employs 4 Indians out of a total of 48 employees, while Indians form 30% of the population in Rosebud County. There may be factors which would naturally result in a lower proportion of Indians being hired.

5.94 Taxes and Royalties:

According to J. A. Caskey, Mine Superintendent, the Big Sky Mine is currently paying royalties of 19 cents per ton, which at the present rate of mining, 180,000 tons per month, amounts to $410,000 per year. This royalty is paid to Burlington Northern Railroad. If the federal lease is consumated, royalties of 17.5 cents per ton will be paid to the federal treasury. At the projected mining rate of 4 million tons per year, this would amount to $700,000 per year. In addition, of course, federal corporate income tax is also paid.

The state and local taxes which the mine would pay are presented in Table 8. The tax rates per ton were provided by Mr. Joe Burrough of Peabody Coal Company. In addition to these

TABLE 8
(See Section 5.94)

STATE AND LOCAL TAXES

Tax	Amount per Ton (Dollars)	Total at Present Rate of 2,160,000 Tons per Year (Dollars)	Total at 4 Million Tons per Year (Dollars)
Real and Personal Property Tax*	.037	$ 79,920	$ 148,000
Net Proceeds Tax*	.081	174,960	324,000
Severance Tax**	.34	734,400	1,360,000
Corporation License Tax	.031	66,960	124,000
TOTAL	.489	$1,056,240	$1,956,000

---

*County Tax

**State tax with some proceeds returned to county

taxes, payments must be made to the Resource Indemnity Trust Fund. Assuming a conservative sale price of $2 per ton, payments at the present mining rate would be $21,600 per year and $40,000 per year at the increased mining rate.

5.95 Services and Supplies:

The Billings urban area will undoubtedly be the source of major services and supplies, as well as the wholesaling center. However, the procurement of most services could be expected in Forsyth and would have an impact on the secondary industries as discussed earlier.

5.96 Housing:

At the present time 6 families live near Colstrip in a trailer court constructed by a local rancher with the assistance of Peabody Coal Company. Seven families, 3 white and 4 Indian, live in Lamedeer, while the remaining 28 employees live in Forsyth.

Colstrip presently has no additional housing opportunities because all existing dwellings are occupied.

If conditions do not change, the majority of future employees could be expected to live in Forsyth. One factor which probably influences decisions on where to live is the road between Forsyth and Colstrip, which is in very poor condition. If it were improved, even more people might choose to live in Forsyth.

The prices of real estate and rentals in Forsyth have risen since coal development began, although the amount of the increase has not been estimated. In the long run, in the absence of such constraints as excessively restrictive zoning, these increases will act to increase the supply of housing. However, in the short run landlords and landowners will benefit at the expense of tenants and buyers.

5.97 Medical Facilities:

A telephone conversation with a hospital employee in Forsyth revealed that a new 25-bed hospital will soon be opened. This conversation also indicated that there are only 2 doctors in the county, both semi-retired. More doctors are needed in the area, a need which is shared by many rural areas. A larger population could attract more doctors or it could make an existing shortage worse. In "Toward A Social Report" by the U. S. Department of Health, Education, and Welfare, it was shown that health and life expectancy were strongly related to the ratio of doctors to patients and average family income level of the area. Average income per family is expected to increase in Rosebud and Bighorn Counties as a result of coal development. In this case, the increase in average income of families already in the area will depend upon the number of employees that come from the existing population, as opposed to new in-migrants.

The situation may occur that the level of health of the poor is not improved by the increase in average income. The availability of health services would be reduced if additional doctors are not attracted to the area.

5.98 Schools:

Although the development of the local resources is causing the area's school systems to grow rapidly, the addition of 10 to 15 additional families would not have large impact on the school systems of the county. During a telephone conversation, Mr. Calvin Wall, Superintendent of Schools in Forsyth, stated that the additional influx of students would not have an appreciable impact on the school system unless a number of the students happened to be in the same grade. The total amount of coal development occurring in the region is having an important impact on the school system. The school system appears to have anticipated the influx of new students and has provided new facilities for them. If, in the future, this were not the case, the addition of 10 to 15 families could substantially reduce the quality of education. Table 9 presents the educational profile of Rosebud and Bighorn Counties in 1970. The college students attend schools outside of the respective counties.

5.99 Roads and Transportation Facilities:

The only means of travel in Rosebud County with the exception of private plane is by private auto. The mine is 35 miles from Forsyth and 122 miles from Billings. While an interstate highway is nearly complete, which will link Billings and Forsyth, the road from Colstrip to Forsyth is in extremely poor condition. While it is presently a county road, the County Commissioners have said that the county does not have enough funds to repair it and has asked the state to take it over. Twenty-eight Peabody

TABLE 9
(See Section 5.98)

SCHOOL ENROLLMENT

	Rosebud	Bighorn
Nursery	31	61
Public	24	37
Kindergarten	36	139
Public	23	131
Elementary	1,112	1,973
Public	900	1,850
High School	348	719
Public	277	662
College	40	23
TOTAL	1,567	2,915
Percent Enrolled		
3 - 34 Years old	50.2	49.4
Median School Years Completed		
Male	11.1	10.7
Female	11.9	11.8
No. of Teachers	108	181

employees currently live in Forsyth and drive to work each day. If mine operations were to expand, it could be assumed that more than half of the new employees would live in Forsyth.

5.100 Impact on Above if Mine Operations Were to Cease:

The closure of Peabody Coal Company's Big Sky Mine would result in the loss of, at most, 48 jobs at the mine and between 49 to 71 jobs in secondary and tertiary industries. Most of these displaced workers would probably find employment at other Montana or Wyoming mining operations, although some workers might choose to remain in the area and work for lower wages.

The loss in state and local taxes would amount to $1,956,000, which would be partially offset by a decline in the demand for services. The federal government would lose $700,000 in royalty payments.

The traffic on the road from Forsyth to Colstrip would be less and the population growth rate lower. In general, the economic impact of closing only the Big Sky Mine would not result in large scale unemployment. However, if it were accompanied by the closure of the other mines in the region and related construction, there would be a situation similar to that around Conrad where construction was halted on the guided missile installation. In the long run, and in the absence of any new stimulus to growth, the area would continue its economic decline, as projected by the Bureau of Economic Analysis. Rising world food prices could reverse the slow decline, which would occur in the absence of coal development.

SECTION 6

ENVIRONMENTAL IMPACT

6. ENVIRONMENTAL IMPACT

6.1 Air Pollution

6.11 Fugitive Dust from Haulage Roads:

During the dry summer months, dust from the dirt access and haulage roads around the coal mine facilities presents a problem. The amount of dust "stirred-up" is directly related to the activity and usage of the dirt roads and trails, as well as to the road bed material. However, in most instances, the "dust problem" has been virtually eliminated by dampening the road surface with water.

6.12 Fugitive Dust from Other Facilities:

Procedures for fugitive dust abatement can be incorporated into the coal loading process although none presently exists at the breaker or storage facilities. However, if fugitive dust is adjudged to be a problem, control procedures will be instituted.

6.13 Planned Air Study:

Peabody Coal Company plans to install three high volume samplers within the next few months to begin collecting ambient air quality data. This information will be submitted to the state upon completion of the study.

6.14 Other Pollution:

No additional pollution is currently being experienced with construction.

6.15 Planned Meteorological Study:

Meteorological equipment will be installed to gather data concerning rainfall, wind speed and direction. This information will be submitted to the state upon completion of the study.

6.2 Water Pollution

Peabody Coal Company will meet or exceed state and federal requirements for water pollution abatement and control, as outlined in the existing Montana Water Quality Standards (adopted October 5, 1967) and proposed water quality standards (16-2.14(10)-S14480 of April 11, 1973), EPA "Interim Effluent Guidance for NPDES Permits" (1 May 1973), and State Land Department Standards S10330.

6.21 Water Sampling Program:

From the beginning of the mine operation, field tests of water have been made for pH once a month. The results have always been above 7.0. (See Table 6.)

In the fall of 1971, Peabody Coal Company began a program of sampling all of its water discharges in the twelve states in which it operates, analyzing monthly samples for about 35 parameters. In the case of Montana, these included a number of special parameters requested by the state, such as sodium, calcium and magnesium. The Peabody Coal Company's goal was to completely characterize all of the nearly 100 discharges by the end of 1972 (see 6.23). A complete year of data is considered necessary to obtain the wide variations which exist due to climatic conditions, topography, mining conditions, and numerous

other factors. While it was believed that many of the parameters being analyzed were not pertinent to coal mining, the company did not have the data to verify this belief at the onset of the program.

In accordance with the Federal Executive Order utilizing the 1899 Refuse Act to require permits on all water discharges into navigable waters or tributaries thereof, Peabody Coal Company initially applied for a permit for the Big Sky Mine with the Corps of Engineers on October 6, 1971. Upon completion of analytical data, a final complete application was filed with the Omaha District Corps of Engineers on February 4, 1972. This supplement contained analyses for permits required under the act and were developed from a single sample. In addition, on March 1, 1972, "application for treated industrial waste discharge permit" was filed with the Montana State Department of Health. To date, no action has been taken on this state application.

As a voluntary follow-up, Peabody Coal Company began reporting its monthly analytical data to the Federal Environmental Protection Agency, Denver Regional Office, and the Montana State Department of Health. Copies are presented in Table 6. These records show that, on the days water was sampled, there was a discharge from Big Sky Mine during only three months since November of 1971. These occurred in November of 1971 and October and November of 1972.

In order to provide a good data base, however, samples were collected on a monthly basis, and from a sump in the pit if there was no discharge during that month. Therefore, it is

believed the samples collected are generally representative of the quality of water which would be discharged had a discharge occurred and if there were no settling ponds.

Many of the values listed on the data sheet in the November 1972 columns may be disregarded, because of the high suspended solids values. It should be noted that all of the water is alkaline. Alkalinity has always exceeded acidity. There has been pH values (at time of sampling) lower than 7.2. The iron values are generally extremely low for some samples, iron values are high, as are the suspended solids.

Settling ponds have been built recently (see Figure 9) to remove suspended solids and when solids are removed prior to water discharge, iron is expected to be below the 4 mg/l average specified in the Federal EPA Coal Mine Effluent Guidelines and within state standards.

In accordance with the 1972 Federal Water Quality Act Amendments, Peabody Coal Company's permit application to the Corps of Engineers under the 1899 Refuse Act has been transferred over to the Denver Region VIII Office of the EPA. Company personnel held one meeting with EPA personnel, along with members of the Montana State Department of Health, to discuss the discharges from Big Sky Mine. It is understood that the EPA Office will review and develop coal mine permits sometime this fall.

In the meantime, the Washington Office, Air and Water Program of EPA, has promulgated "Interim Effluent Guidance for NPDES Permits." Those portions pertinent to coal mining are attached as Appendix 9.

6.22 Settling Ponds:

The water produced or collected as a result of mining is neither toxic nor acid. (See Table 6.) All water leaving the mine must pass through a minimum of two, and a maximum of four settling ponds before reaching Rosebud Creek.

Two of the dams were built by the previous owner (1 and 2 on Figure 9); one by Peabody Coal Company, using standard engineering practices (4); and the latest dam (3) was designed and built according to the publication "Design of Small Dams" by the U. S. Department of Interior, Bureau of Reclamation, 2nd Ed. 1973. (See Figure 10.) All future dams will be constructed according to these criteria, unless otherwise directed by the Department. All sizeable ditch banks and dams will be covered with topsoil, seeded at the appropriate time and will be maintained in accordance with state law.

6.23 Analytical Data:

Proposed Montana Water Quality Standards (16.2.14(10-S14480), dated April 11, 1973, classify the Yellowstone River drainage from the Billings water supply intake to the North Dakota line as water use classification B-D_3. The Rosebud is a tributary of the Yellowstone within this classification and Miller Coulee is an intermittent tributary of the Rosebud. Therefore, class B-D_3 Montana Water Quality Criteria (State of Montana Water Pollution Control Council Water Quality Criteria, adopted October 5, 1967) would apply.

Data collected is shown in Table 6. As described above,

the most recent settling pond facilities has been provided since the testing data was collected. Therefore, data parameters of flow, from Miller Coulee are no longer pertinent because of the present handling of mine discharges.

The monthly water quality data will be submitted as required in Chapter 325, Sessions Law of Montana, Section Regulations--Water Quality (1)(b)(vi).

6.24 Protection of Water Resources:

Above the mining recovery line, as well as temporary ditches that will be subsequently mined out, ditches and levees will be constructed to intercept natural surface runoff waters and divert them around the mining area, then back into a natural drain. This should eliminate any contamination which the water could pick up if the water were allowed to flow into the active mining pit and then be pumped out.

6.3 Noise Impact

6.31 General:

On the basis of a noise survey conducted July 25, 1973 at Peabody's Big Sky Mine, it is reasonable to assume that noise generated by mining operations will seldom be great enough to be of nuisance value at the mine property boundaries, and never a problem in outlying populated areas. This assumption does not necessarily include or exclude blasting noise, because planned noise tests on blasting have not yet been conducted. (See Appendix 10.)

The main reason noise is not expected to be a problem is that 300 foot high buttes interlacing the property acoustically baffle and contain the noise within the mining property. As a practical matter, the loose dirt in the spoil piles and the pits themselves act as very effective noise mufflers. In addition, the nearest populated areas are so far away that even if the intervening terrain were completely flat, the normal spherical spreading losses would attenuate the mine-generated noise to levels well below nuisance value.

There is one exception to the above remarks. A small trailer court, built to house about twelve mining families, lies just outside the property boundaries on the northeast corner. As mining operations progress toward this area, the noise level will increase to a value which may be offensive to people living in the trailer court. When mining operations approach the trailer court, Peabody Coal Company will discuss eventual relocation with the owner. This problem is not critical at this time because it will be many years before operations approach the trailer court.

6.32 Effect on Wildlife:

During construction and mining, the noise from operating machinery and blasting could cause irritation and fright among wildlife using the area and discourage wildlife occupancy in the immediate area. The stress effect of noise on wildlife is not completely known, but it might be expected that following an initial "startle" effect, wildlife would quickly adapt to the

noises of "normal" operations and subsequently ignore them. Since blasting occurs relatively infrequently, the noise of blasting is not expected to cause any serious effects on wildlife.

6.4 Waste Disposal

See Section 4.8.

6.5 Archaeology

See Section 5.7 and Appendix 8.

6.6 Aesthetics

See Section 5.8.

6.7 Biological Conditions

6.71 Vegetation:

See Section 5.51.

6.72 Wildlife Impact:

Although some productivity loss due to habitat destruction will occur, this habitat can be replaced through proper reclamation procedures and methods.

There are no known fragile areas which may be disturbed which could not be replaced through proper reclamation methods and procedures. Most sandstone outcroppings will not be disturbed by mining operations. Peabody Coal Company has not experienced any damage of these sandstone outcroppings due to blasting.

6.8 Termination and Abandonment

6.81 Land:

Most of the land involved in the mining operation will be mined under the terms of a mining lease with the Burlington-Northern Railroad Company. All lands mined will be reclaimed under the conditions and regulations of the Montana Department of State Lands and will, after reclamation work is completed, revert to the railroad company. It is assumed that upon completion of the reclamation work the company will again lease the lands for pasture as it has in the past.

In some instances, Peabody Coal Company acquired title to the surface of the land over either federal or railroad-owned coal. After the land is mined and reclaimed, the original landowner has the option of buying back the surface at a very nominal rate. It is assumed that the original owner will exercise his option, but in case he should not, Peabody Coal Company will retain title to the land and lease it for pasture until such time as the land is traded for other coal land or sold.

6.82 Mining Facilities:

All mining facilities, equipment, and buildings will be dismantled and removed from the premises. Roads will be reclaimed in accordance with state regulations and all reclamation of mined areas will be completed.

6.83 Water:

See Section 6.2.

6.84 Employees:

Employees will be offered jobs in other locations insofar as employment is feasible and acceptable.

6.85 Community Effect:

See Section 5.9

See Section 6.21
Water Sampling Program--page 73

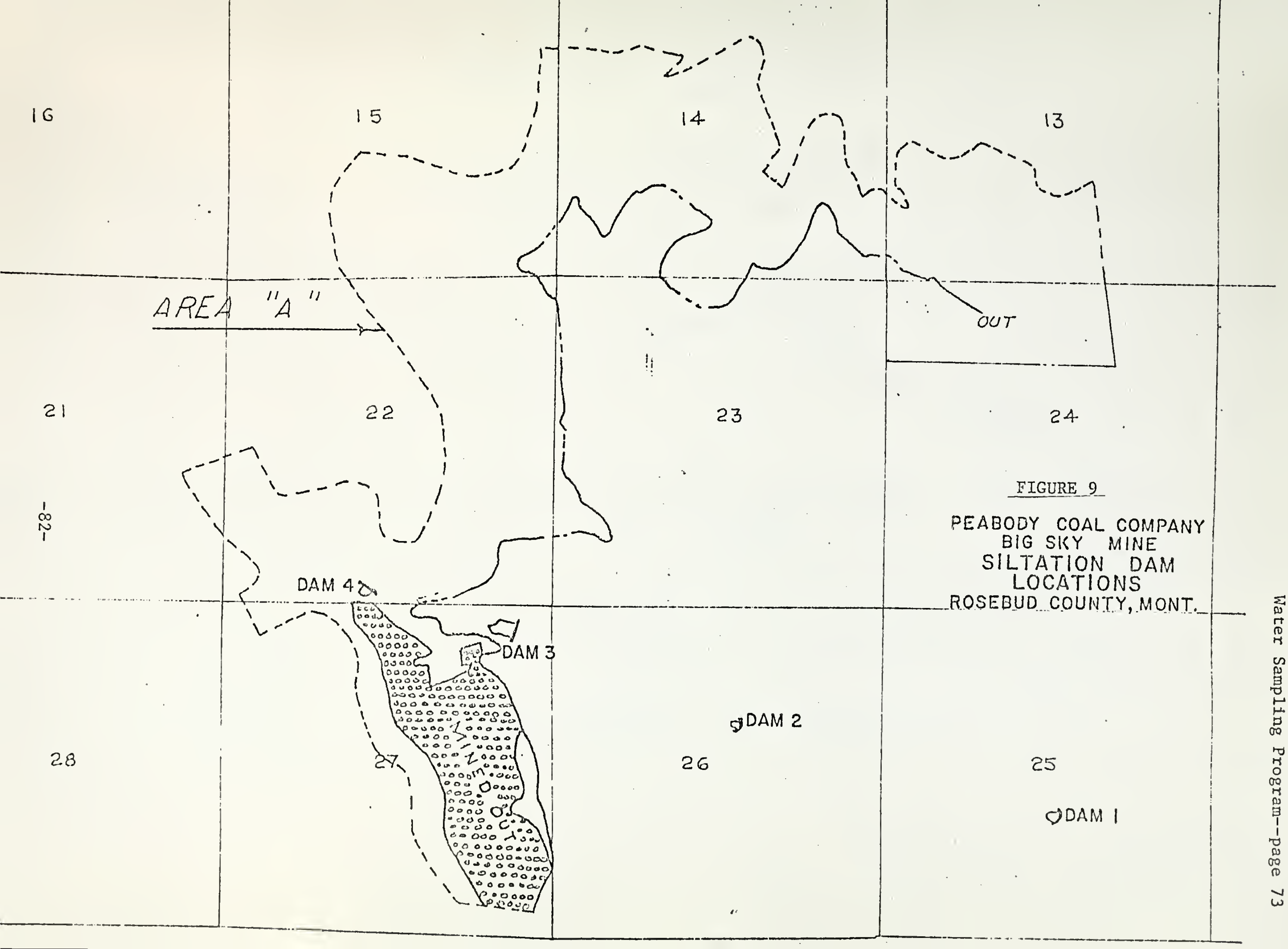
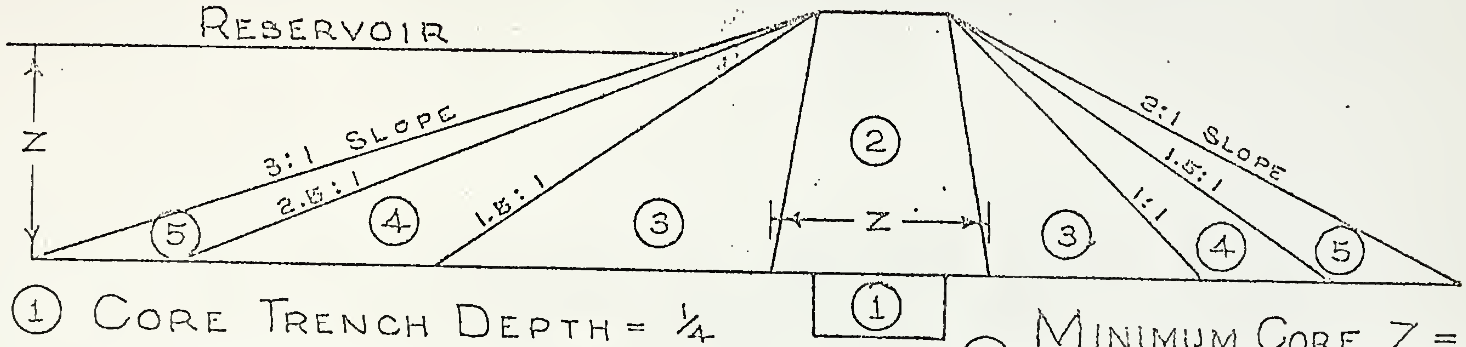


FIGURE 9

PEABODY COAL COMPANY
BIG SKY MINE
SILTATION DAM
LOCATIONS
ROSEBUD COUNTY, MONT.

TYPICAL EARTH FILL DAM SECTION

See Section 6.22
Settling Ponds--page 76



① CORE TRENCH DEPTH = 1/4 OF DAM HEIGHT.
TOP OF DAM & CORE TRENCH APPROX. 15' WIDE OR DOZER BLADE WIDTH.
CORE IMPERVIOUS MATERIAL COMPACTED.

② MINIMUM CORE Z = DEPTH OF WATER. IMPERVIOUS FOUNDATION.

③ MINIMUM CORE FOR DAMS ON PERVIOUS FOUNDATIONS.

④ MAXIMUM SIZE CORE ON PERVIOUS FOUNDATIONS.

⑤ SEMI PERVIOUS MATERIAL OF SELECTED STABILITY GRADUATED IN COARSENESS TO OUTER SLOPES. WELL COMPACTED.

FIGURE 10

See Section 6.21
Water Sampling Program--page 73

Table 6

SUBSIDIARY KENNECOTT COPPER CORPORATION
CENTRAL LABORATORY
P. O. BOX 39 • FREEBURG, ILLINOIS 62243
TELEPHONE 618.539.3359

Mine *Big Sky* State *Montana* Core Permit No. *MT-2SB-OXT-2-000632*

Discharge Serial No. *001* Collection Point *NW¼, SW¼* Sec *26* Twp ____ Rge ______

Year *1971* *LAB. No.* *1-30-71*

PARAMETER	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DE
DATE											23	
Flow gpd											167,000	
Temp. F At Time of Sampling											36°	
Ph At Time of Sampling											7.4	
Spec. Cond. Micromhos @ 25 C												
Turbidity Jackson Units												
Ph @ 25 C												
Color Pt-Co Units												
Volatile Solids mg/l												
Dissolved Solids mg/l												
Suspended Solids mg/l												
Total Solids mg/l												
Hardness Total mg $CaCO_3$/l												
Alkalinity mg $CaCO_3$/l												
Acidity mg $CaCO_3$/l												
Sulfate (as S) mg/l												
Oil & Grease mg/l												
COD mg/l												
Organic Nitrogen (As N) mg/l												
Nitrite (As N) mg/l												
Ammonia Nitrogen (As N) mg/l												
Nitrate (As N) Mg/l												
Nitrogen Total mg/l												
Bicarbonate mg $CaCO_3$/l												
Chloride mg/l												
Flouride mg/l												
Bromide mg/l												
Sulfide (As S) mg/l												
Chromium ug/l (Total)												
Copper ug/l												
Cadmium ug/l												
Lead ug/l												
Manganese ug/l												
Iron ug/l												
Mercury ug/l												
Zinc ug/l												
Aluminium ug/l												
Nickel ug/l												
Phosphorus (Total) mg/l												
Arsenic ug/l												
Beryllium ug/l												
Magnesium mg/l												
Calcium mg/l												
Selenium ug/l												
Silver ug/l												
Sodium mg/l												
Potassium mg/l												
Cobalt ug/l												
Boron ug/l												
Cyanide mg/l												
Phenol ug/l												
Chromium Trivalent ug/l												
Chromium Hexavalent ug/l												
Dissolved Iron ug/l												

PEABODY COAL COMPANY

SUBSIDIARY KENNECOTT COPPER CORPORATION

CENTRAL LABORATORY

P. O. BOX 39 • FREEBURG, ILLINOIS 62243

TELEPHONE 618-539-3359

Mine BIG SKY State MONTANA Core Permit No. MT-258-OXT-[illegible]

Discharge Serial No. ______ Collection Point NW¼ SW¼ Sec 26 Twp ____ Rge ______

Year 1977 Lab. No.	*** 2-99m	*** 2-194m	*** 2-280		*** 2-432	*** 2-661M	*** 2-796	*** 2-899m	*** 2-10[illegible]	2-1082	2-1199	
PARAMETER	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
DATE	31	29	27		10	19	8-2	9-5	10-6	30	30	
Flow gpd	1000	2000				—	—	—	—	7500	6000	
Temp. F At Time of Sampling	34°	35°	46°		54	67	72°	76	58	42	44	
Ph At Time of Sampling	7.3	7.5	7.2		7.4	7.3	7.3	7.4	7.6	7.7	7.8	
Spec. Cond. Micromhos @ 25 C	3100	3100	3000		2800	3000	3600	2800	2800	2000	2400	
Turbidity Jackson Units	22	35	14		.8	2.3	3.2	2.5	8.1	110	13,500	
Ph @ 25 C	8.04	7.8	7.95		8.0	8.0	7.9	7.8	7.7	7.5	6.9	
Color Pt-Co Units	4	4	5		8	4	6	4	6	5	5	
Volatile Solids mg/l	4490	586	735		758	766	500.1	758	586	521	3605	
Dissolved Solids mg/l	2961.8	3453	3362		3199	3448	2804	2711	2737	3016	2658	
Suspended Solids mg/l	190.7	0	0		211	400	126.6	311	131	0	2391.7	
Total Solids mg/l	3152.5	3453	3362		3410	3848	2930.6	3022	2868	3016	3162.1	
Hardness Total mg $CaCO_3$/l	1747.3	1884.	1760.1		1776	1827	1674.6	1562	1735.7	1711.7	1163.6	
Alkalinity mg $CaCO_3$/l, Bpp. Phen.	282.1	184*	181.3*		358.2*	254*	216.9	254	611.2	527.5	146	
Acidity mg $CaCO_3$/l phen.	0	0*	0*		0*	0	0	32.5	204.5	143.2	30.2	
Sulfate (as S) mg/l	605	5250	500		550	560	575	510	500	460	500	
Oil & Grease mg/l	.1	0			—	2.9	—	—	0	—		
COD mg/l	4.88	20.4	3.97		9.29	9.47	4.88	10.2	1	8.37	3355	
Organic Nitrogen (As N) mg/l	.56	2.24	1.54		.56	0	—	6.3	.06	.5	2.4	
Nitrite (As N) mg/l	—	—	—		—	—	—	—	—	—		
Ammonia Nitrogen (As N) mg/l	0	0	2.10		0	0	—	<0.1	1.2	3	2.2	
Nitrate (As N) Mg/l	0.61	9.85	11.90		1.43	1.30	.25	.16	.3	20	21.5	
Nitrogen Total mg/l	1.17	12.09	15.54		1.99	1.30	.25	6.56	1.56	23.5	31.1	
Bicarbonate mg $CaCO_3$/l	2345	908.8	181		359	254	272.4	254	611.2	527.5		
Chloride mg/l	4.90	9.3	8.6		6	17	13.5	.22	2.75	11.3	14.1	
Flouride mg/l	.79	.66	.06		.16	.21	.125	.19	.18	.29	.21	
Bromide mg/l	2.54	—	.41		.14	.41	.14	.14	.25	.20	.21	
Sulfide (As S) mg/l	0	—	—		0	—	—	—	—	—		
Chromium ug/l (Total)	18	3	5		0**	0**	1.3**	0	0	1.2	2.7	
Copper ug/l	16	27	10		0	30	7	10	10	10	850	
Cadmium ug/l	15	11	0		0**	0**	0**	1	0	0	3.78	
Lead ug/l	118	210	0		16**	0**	34**	6	0	19.5	2,000	
Manganese ug/l	82	140	66		25	50	35	20	730	500	6,000	
Iron ug/l	305	640	420		70	100	130	155	600	3525	514,000	
Mercury ug/l **	0	.11	0		.15	0	.28	.015	0	.159	2.24	
Zinc ug/l	31	18	42		18	23	0	155	60	15	2,035	
Aluminium ug/l	600	660	1230		280	150	300	300	300	5,000	360,000	
Nickel ug/l	175	140	110		165	120	180	10	245	150	1,065	
Phosphorus (Total) mg/l	0	.013	0		.002	—	—	.05	—	—		
Arsenic ug/l	12	6.0	1.4		1.8	0	0	26	0	36.4	52.6	
Beryllium ug/l												
Magnesium mg/l	21.8	28.5	255.7		272.0	270.0	292	—	281.5	246.5	1,110	
Calcium mg/l	183	37.2	308.3		266.0	306.0	183	—	262	634	258,000	
Selenium ug/l	—	0	—		.5	—	—					
Silver ug/l					—	—						
Sodium mg/l	192	180	191.9		154.6	136.0	183	120	14	131	106	
Potassium mg/l												
Cobalt ug/l												
Boron ug/l												
Cyanide mg/l												
Phenol ug/l												
Chromium Trivalent ug/l												
Chromium Hexavalent ug/l												
Dissolved Iron ug/l					—	—						
Kjeldahl Nitrogen mg/l	.56	2.24	3.64		.56	0	—	6.4	1.86	3.5	9.6	

* b.p. percent. pH 8.3 ~~Pb, Cd, Cr chelated 3/77~~ *** Sample Taken From Sump In Pit

** apdc chelation ** Hg values 1 ppb and over invalid No Mine Discharge [illegible]

PEABODY COAL COMPANY

SUBSIDIARY KENNECOTT COPPER CORPORATION

CENTRAL LABORATORY

P. O. BOX 39 · FREEBURG, ILLINOIS 62243

TELEPHONE 618-539-3359

Mine BIG SKY State Montana Core Permit No. MT-25B-OXT-2-000632

Discharge Serial No. 001 Collection Point NW¼ SW¼ Sec. 26 Twp. ____ Rge. ____

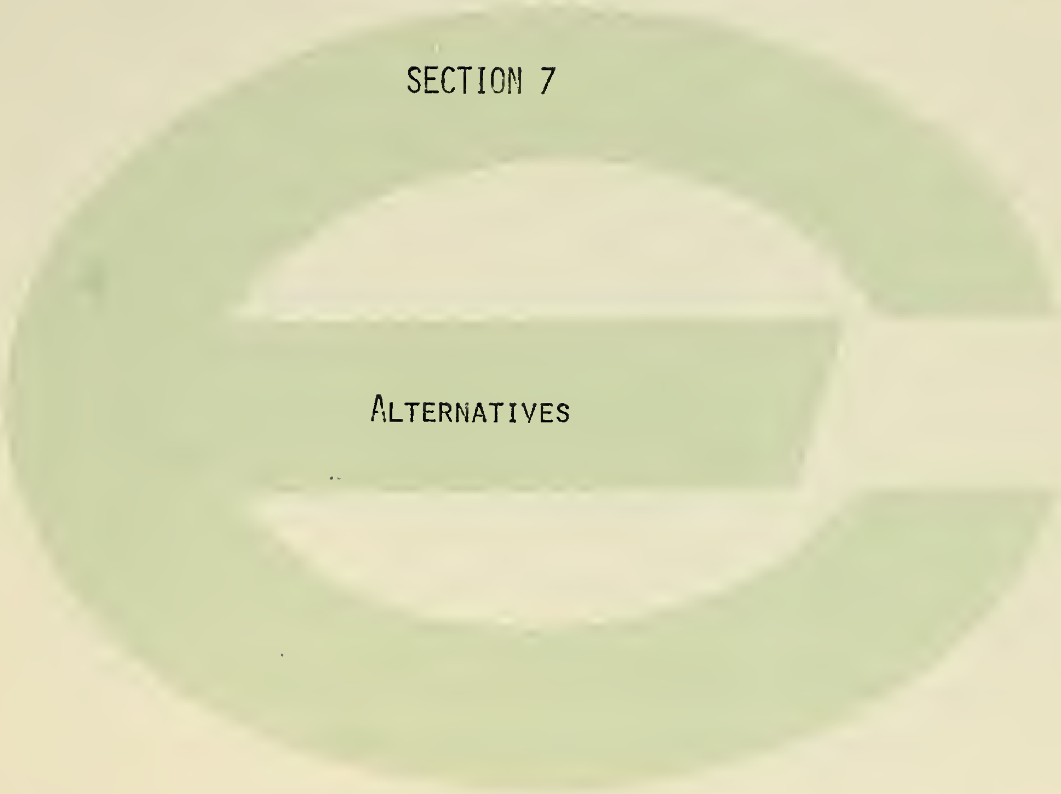
Remarks: ____

YEAR 1973

PARAMETERS	* JAN	* FEB	* MAR	* APR	X * MAY	* JUN	* JUL	* AUG	SEP	OCT	NOV	DEC
Laboratory Number	3-140	3-295	3-433	3-556	3-645	3-800	3-909	3-1016				
Date Sampled	29	3-2-73	4-2-73	5-1-73	31	7-2	31	9-4-73				
Flow (g.o.d.)	—	—	—	—	—	—	—	—				
Temp. °F @ time of sampling	45°	47	—	—	—	—	—	—				
pH @ time of sampling	7.5	7.5	7.4	7.5	7.6	7.7	7.7	7.6				
Specific Conductance (micromhos/cm) @ 25°C	2800	2300	N.D	2900	3000	2700	2200	2700				
pH @ 25°C	7.1	7.3	7.5	7.7	7.8	6.5	7.4	7.5				
Turbidity (J.T.U.)	.9	4.0	27	22	5.7	2.8	.5	4.0				
Color (Pt-Co units)	5		—	8	5	5	5	5				
X Total Solids (mg/l)	2474	1922	—	2485	2634	2556	2473	2459				
Dissolved Solids (mg/l)	2474	1922	—	2252	2593	2548	2465	2441				
Suspended Solids (mg/l)	0	0	50	233	41	8	8	18				
Volatile Solids (mg/l)	346		—	387	526	422	644	427				
Sulfate as Sulfate (mg/l)	1440	1000	1160	1100	720	1160	1070	1130				
Sulfide (as S°) (mg/l)	—	—	—	—	—		—	—				
Nitrite (as N°) (mg/l)	—	—	—	—	—	—	—	—				
Kjeldahl N (as N°) (mg/l)	8.4	—	—	.7	.5	1.0	.6	.7				
Ammonia (as N°) (mg/l)	.5	—	—	.4	.3	.6	.6	.2				
Organic N (as N°) (mg/l)	7.9	—	—	.3	0	.4	0	.5				
Nitrate (as N°) (mg/l)	.7	—	—	1.1	.5	1.0	8.6	2.5				
Total Nitrogen (as N°) (mg/l)	9.1	—	—	1.8	1.0	2.2	9.2	3.2				
Chloride (mg/l)	13	66	X	11	35	23	17	60				
Bromide (mg/l)	.23	—	—	.62	.39	.24	.15	.40				
Fluoride (mg/l)	.18	.16	.21	.16	.24	.71	.52	.29				
Hardness (mg/l as $CaCO_3$)		—	—	1440	1320	1462	1260	1430				
Acidity (mg/l as $CaCO_3$) b.p. potent. pH 8.3	75	51	177	216	146	182	200	249				
Alkalinity (mg/l as $CaCO_3$) potent. pH 3.7	424.3	373	498	546	395	492	321	514				
Chemical Oxygen Demand (mg/l)	0	0	—	4	3	4	4	0				
Aluminum ug/l	200	300	5300	500	750	250	300	400				
Copper (ug/l)	10		—	0	0	5	10	0				
Nickel (ug/l)	95		—	88	402	264	379	567				
Manganese (ug/l)	240		—	90	60	40	50	35				
Iron (ug/l)	250	550	—	300	715	160	105	435				
Zinc (ug/l)	45		—	71	0	122	0	0				
Cadmium (ug/l)	56		—	77	71	98	43	74				
Chromium (Total) (ug/l)	21		—	0	15	19	7	16				
Lead (ug/l)	65	585	106	100	118	1334	125	39				
Mercury (ug/l)	.09		—	.25	.04	.08	.38	.34				
Arsenic (ug/l)	—			2	1	1	0	0				
Selenium (ug/l)				—	—	—	—	—				
Calcium (mg/l)	222	148	254	160	181	169	170	190				
Magnesium (mg/l)	248	178	127	200	227	238	200	237				
Sodium (mg/l)	119			39	159	152	118	130				
Bicarbonate Alkalinity (as mg/l $CaCO_3$)	424.3	373	498	546	395	492	321	514				
Phenols (ug/l)					—	—	—	—				
Sliver (ug/l)					—	—	—	—				
Dissolved Iron (ug/l)		150	85	45	135	90	85	85				
Boron (ug/l)					—	—	—	—				
Oil and Grease (mg/l)	0			20	—	—	0	—				
Phosphorous (Total) (mg/l)	0			0	—	—	0	—				
Flow - Gal./Mo.				—	—	—	—	—				
Dissolved Aluminum ug/l				200	250	700	700	200				

*Pit Sample. No Discharge

X Total Suspended Volatile run — dissolved calculated May →



SECTION 7

ALTERNATIVES

7. ALTERNATIVES

The state has several alternatives regarding the application for a mining permit by Peabody Coal Company. These include: 1) approving the permit and mining and reclamation plans proposed by the company, 2) rejecting the permit and prohibiting mining, 3) postponing action pending further study, 4) requiring changes in mining, reclamation goals or of proposed sites.

The following discussions concern these alternatives:

1. Approving the application for permission to mine:

With such approval, mining and reclamation will be done in accordance with federal and state laws and regulations and State Land Department decisions.

2. Rejection of the permit:

The results of discontinuing mining in the area include: 1) closing the mine, 2) some unemployment in the area, 3) loss of tax revenue to the county, state and nation, 4) requiring Minnesota Power and Light Company to find a new energy source for the production of electricity, 5) possible loss of electrical supply to residents serviced by Minnesota Power and Light Company 6) no disturbance of presently unmined land surfaces, 7) no potential disturbance to wildlife in the area, 8) no increase in population or transportation activities in the area directly attributable to the mine, 9) no disruption of agriculturally based activities, and 10) no inconveniences caused to residents and visitors by mining activities prior to completed reclamation, 11) no potential increase in dust emissions, and 12) no increased use of water.

3. Postponing action pending further study:

The results of this alternative include: 1) interruption of fuel supply to Minnesota Power and Light Company, 2) interruption of reclamation currently in progress if reclamation techniques are a study subject and current methods are disgarded, 3) a layoff of mine personnel, 4) temporary loss of tax revenue, 5) would allow time for more detailed investigations concerning environmental situations, 6) would allow time for development of less disturbing mining techniques, and 7) would allow time for development of improved reclamation techniques.

4. Requiring changes in mining, reclamation goals or of sites.

a) Mining methods:

The alternative of underground mining methods could be examined since they would cause less immediate damage to the land surface than strip mining. However, several factors associated with these methods do not make them environmentally nor economically feasible: 1) underground mining could not be done economically because of the relatively shallow overburden of 50-100 feet over the Rosebud-McKay seams, 2) strip mining is a safer method of mining for employees, 3) nearly 16 times the number of employees are required for underground mining, 4) the shallowness and composition of the overburden indicate it would not support the necessary roof for underground operations.

b) Reclamation goals:

Alternative goals of reclamation include: 1) providing range land with diverse vegetation, 2) providing crop land with a monoculture vegetation, 3) developing recreational sites including

artificial lakes, second home area and other increased recreational uses, 4) creating water impoundments for storage of irrigation supplies to be used for increased agricultural production and 5) a combination of any two or all of the above.

c) Other Sites:

If the state rejects this permit in favor of mining other sites in the state not leased by Peabody Coal Company, the conditions listed above under no mining would be in effect. However, among the advantages of continuing to mine existing areas include better utilization of existing services and transportation facilities and confinement of possible pollution problems to fewer areas.

SECTION 8

Adverse Environmental Effects Which Cannot Be Avoided

8. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Adverse effects which cannot be avoided will be temporary assuming that reclamation is successful and that there is an eventual cessation of mining activities. These include:

1) Land. The land will be temporarily scarred by mining activities and although it will be reclaimed for productive uses, it will not be exactly the same and will show evidence of its use for strip mining.

2) Wildlife. The normal habitat and activities of wildlife in the area will be disturbed during the period of mining, but with reclamation this should not have a permanently adverse effect.

3) Agricultural production. For the period of mining and until reclamation is successful, the production of agricultural products will be reduced for the area and its subsequent restoration will depend upon the goals and success of reclamation efforts.

4) Population. There will be a slight increase in population of the area with the possibility of increased social problems and demands on transportation facilities.

5) Water. The use of water for mining activities and dust abatement should not produce a noticeable change in water quantity in the area; however, there will be a disruption of the normal water drainage and an undetermined effect on ground water sources.

6) Aesthetics. During the period of mining, the aesthetics of the immediate mining vicinity will be displeasing and even upon successful reclamation may annoy some people with the change in natural contours and configuration of the landscape.

7) Vegetation. Although reclamation goals as established by the state are directed toward providing a similar vegetation cover and composition as existed prior to mining, the exact mixture will be impossible to achieve.

SECTION 9

RELATIONSHIPS OF SHORT TERM USES AND MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

9. RELATIONSHIPS OF SHORT TERM USES AND MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY.

Mining coal in a particular area at this time forecloses future options, such as not being able to mine it at a future time. However, utilization of the coal at this time will help maintain national energy needs while research and development of alternate energy sources is being conducted. Some land will be temporarily unavailable for other uses during the time between mining and completion of reclamation. The amount of disturbed land at any given time during the projected life of the mine is a small fraction of 1% of the county in which the Big Sky Mine is located. The coal is a non-renewable resource but the land surface supports renewable resources which can be put back into a productive state after coal removal. Decrease in use of coal for power generation could necessitate an increased use of other non-renewable resources such as gas and oil or require additional environmentally disrupting facilities to provide hydroelectric power.

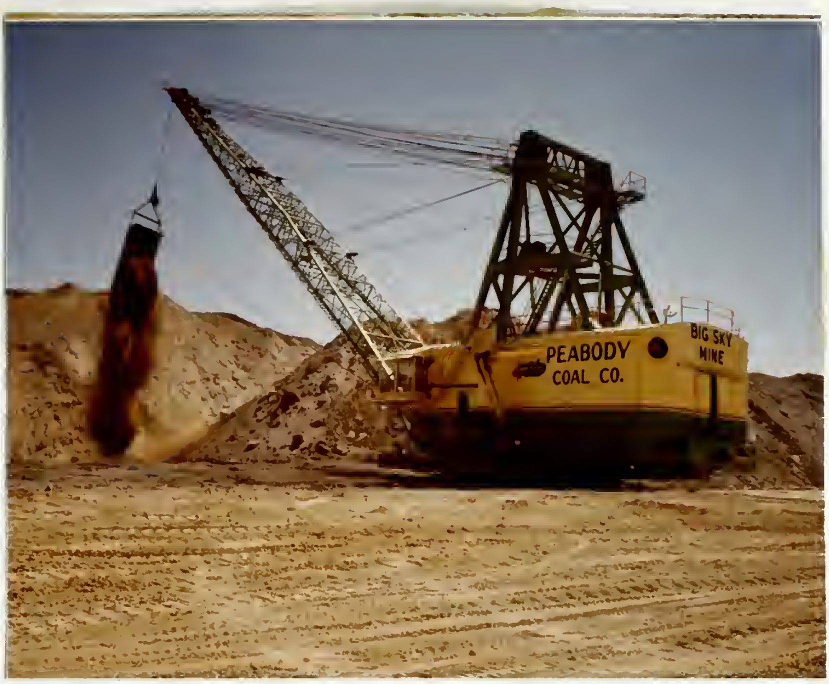
SECTION 10

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

10. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Mining of coal requires the use of energy to power trucks, cars, haulers, loaders and other mobile equipment. Metal and wood products used in equipment, and structures is essentially irretrievably committed. However, these materials could not be manufactured and used for other purposes without the use of energy for processing and harvesting. If the land remained in agricultural use, certain amounts of energy, fuels and materials would also be used.

The use of the coal at this time is an irreversible commitment of resources (see Section 9) and the natural state of the land will be replaced with a different topography.

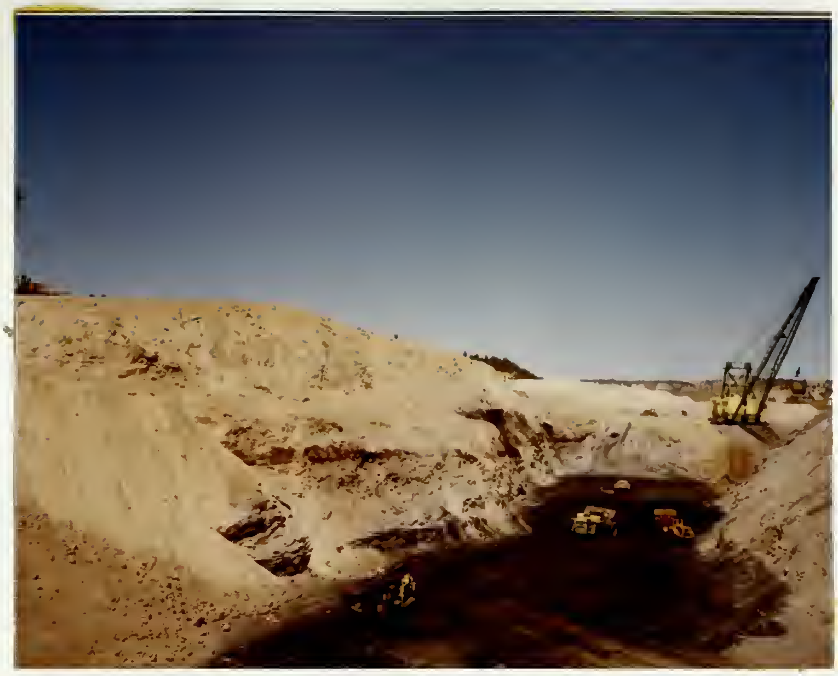


No. 1. Removal of overburden by the 7400 Marion dragline.
See Section 3.71--page 24.

No. 2. Overburden material after removal.
See Section 3.7--page 24.

No. 3. Removal of coal using a Marion loading shovel and an off-highway truck.
See Section 3.3--page 19.

No. 4. Removal of overburden by dragline in background. Loading coal into truck by means of a 988 Caterpiller front-end loader.
See Section 3.3--page 19.



No. 5. Exposed coal seam with dragline, off-highway trucks, and front-end loader.
See Section 3.1--page 19.

No. 6. 120 ton off-highway truck.
See Section 3.52--page 21.

No. 7. Present loading facility--crushing, sizing, and loading equipment.
See Section 3.54--page 22.

No. 8. Coal laden train leaving loading facility.
See Section 3.54--page 22.

No. 9. Water truck for dust suppression on haulage roads. See Section 3.9--page 29.

No. 10. Graded overburden from spoils. See Section 4.22--page 36.

DATE DUE

MSL MAR 20 '74
MSL JAN 3 1 '76
MSL DEC 21 '77
4-26-78

S/622.33/L3ep
Peabody Coal Company
Environmental impact report, Peabody Coal Company, Big Sky Mine

STATE DOCUMENTS

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